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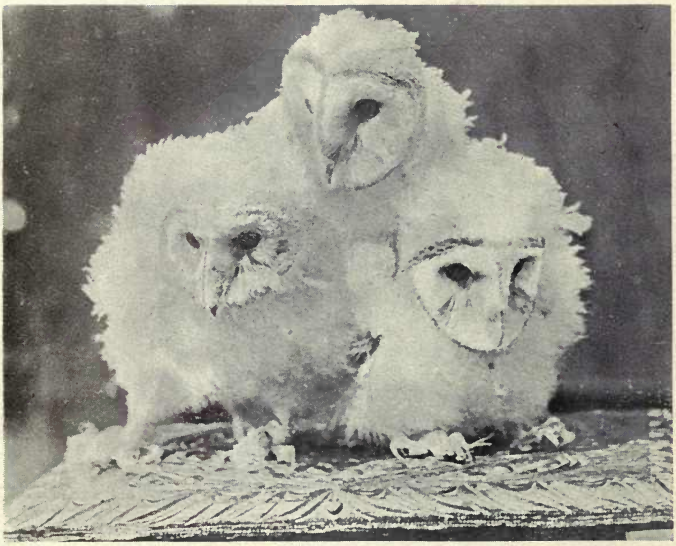
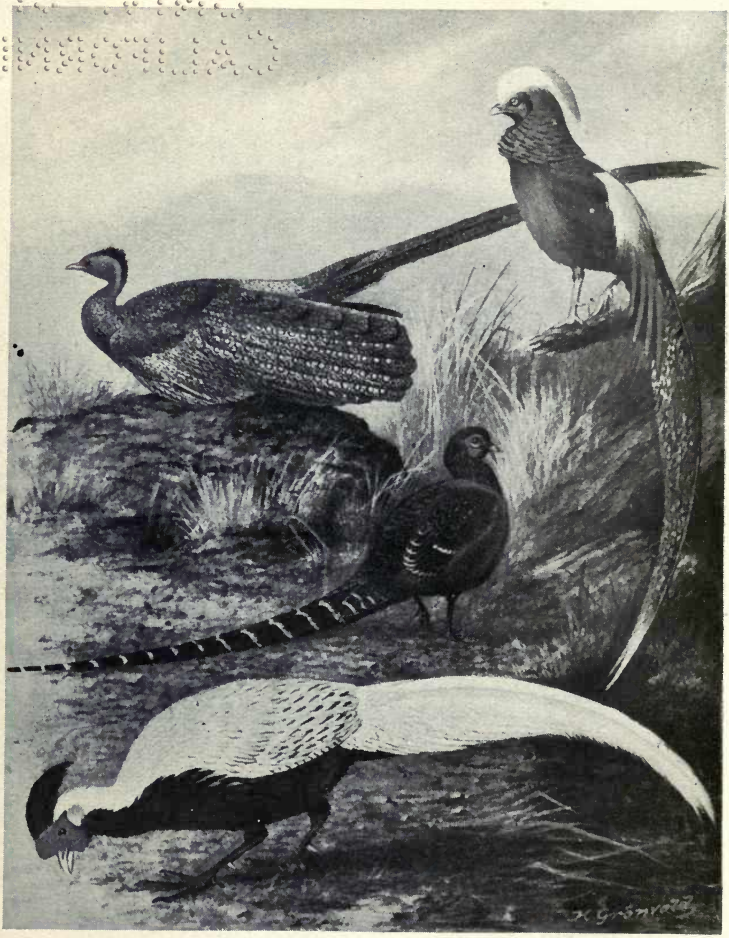


YOUNG OF BARN-OWL.

Although their white down is very different from the feathers of the old birds these nestlings have the face just like the adult.



TYPES OF PHEASANTS.

Argus (top left), Golden (top right), Mikado (centre), Silver (bottom), showing different styles of masculine decoration.

Frontispiece.

BIRD BEHAVIOUR

PSYCHICAL AND PHYSIOLOGICAL

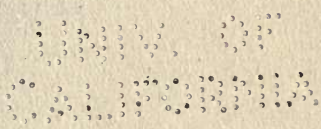
BY

FRANK FINN, B.A. (Oxon), F.Z.S.

Late Editor of "The Zoologist"

AUTHOR OF

"BIRDS OF THE COUNTRYSIDE," "EGGS AND NESTS OF BRITISH BIRDS,"
"THE WORLD'S BIRDS," ETC.



"Behold the fowls of the air."—St. Matthew vi. 26

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BIRD BEHAVIOUR

CHAPTER I

Importance of subject—Incompleteness of our information about even the commonest species—Distinction between major and minor habits—General activities or tricks of manner—Greater importance of the latter in classification—Errors to be avoided in observation.

THE study of birds is often looked down upon by general zoologists as a trifling pursuit, and the reason of this is not far to seek; what is called zoology nowadays is for the most part the study of comparative anatomy, and from this point of view birds are of extremely small interest; they are remarkably uniform in their general structure, and such variations of note as do occur are chiefly confined to a few flightless families, such as Ostriches and Penguins.

One need not, indeed, be an anatomist to realize the comparatively small structural interest of birds; a bird is at once and by everybody recognized as such, while among the mammals, their rivals in high development, one gets such extraordinarily different types as whales, mice, bats, horses, lions,

and men, most of which differ from each other more than the earliest known bird, the *Archæopteryx* of Jurassic times, does from the modern Sparrow in the back-garden.

On the other hand, the numerous species and families of birds and their close alliance with each other afford, by this very narrow range of differentiation, an attractive and philosophical study; among them survive types which in mammals have become "missing links" or are only discoverable in the fossil state. In fact, it is the survival of so many connecting forms that makes it so difficult to group the families of birds into larger "orders," a difficulty which only occurs with mammals when we look back among their fossil predecessors preserved among the rocks.

We look, for instance, with interest upon the remains of the various ancestral predecessors of the horse family, as exhibited in museums, and try to realize what changes of habit must have occurred to convert a small animal with paws into a large one with a single hoofed toe on each foot. But among the birds, if we go to the Duck family (*Anatidæ*) we find still in existence practically all the links between a light-bodied, large-winged bird with non-waterproof plumage and half-webbed feet with large grasping hind-toe, and almost exclusively aquatic diving Ducks which rival the Grebes and Cormorants in their subaqueous performances, and exhibit almost as much modification of structure. And the habits of these can be

studied, for they are not only living, but accessible; the semi-wader at the beginning of the series, the Australian Magpie-Goose (*Anseranas semipalmata*) is no rarity, and I have spent much time in studying a full-winged specimen at Kew, while the habits of many others of the family exemplifying the gradations I have mentioned are accessible either to direct observation or to any one who can look up bird literature.

In fact, the Duck family is one of the most interesting of all animal groups for any one interested in biological problems, owing to the wide distribution of its members, their essential and obvious alliance combined with equally striking differences —some obviously adaptive, others more inexplicable —and I shall have a good deal to say about them in the course of this book, especially as they are familiar exhibits in many public parks, and thus available for everybody's observation.

The availability of birds, as a class, for study gives them, in fact, an importance in the study of animal habits which fairly outweighs their insignificance from the morphological point of view; and I personally have never admitted that the study of structure is more important than that of habit, considering that it only acquires its pre-eminence from the fact of demanding a professional training which is the prerogative of a few only. When one comes to think of it, we ourselves only surpass the other mammals in virtue of our habits, being structurally simply monkeys on our hind legs; yet

he would be a bold zoologist who would claim that comparative anatomy is a more important study than that of the manifold activities of mankind. If one admits that the study of habit is to be taken seriously—and of late there has been a decided trend in that direction—bird-watching needs no apology, for the habits of birds are of manifold variety, and not by any means fully understood, even in the case of the commonest and most familiar species. In fact, these are sometimes, perhaps, less well understood than the comparatively inaccessible ones ; it has often struck me, in view of the excellent observations that have been made of late years in the Antarctic by various expeditions, that we know more about the mind and life of the Adélie Penguin, one of the remotest birds on the globe, than we do about those of the Peacock, the best known by sight and reputation of all birds for a couple of thousand years.

And here one must bear in mind that an observer should be no respecter of persons ornithologically ; a bird is not necessarily more worth observing because it is difficult of access, and that naturalist was very unscientific who said about the Sparrow, " I have got into the habit of not noticing this bird." Personally I am always seeing something fresh in the humble Sparrow's performances, and though my taste as a fancier lies in the direction of birds of beauty, I must admit that the humbler species are often more interesting. But they are not necessarily so ; dowdiness is no more a sign of

intellect in a bird than in a human being, and Aristotle was quite right in stigmatizing some birds as "dull in colour and leading a dull life," while some of those which are stigmatized as "garish" possess habits and qualities of surpassing interest, the Peacock in particular. I particularly mention the Peacock, because it is a purely Indian bird, but widely diffused about the world in a domestic state; but its domestication is not rigorous, so to speak, and it is allowed to lead practically a natural life. This needs to be noticed, because there is a regrettable tendency among naturalists to confine their observations to the wild birds native to their own country, to the neglect of introduced, domesticated, and captive species.

A free bird is, of course, other things equal, the best and most instructive subject for observation, and many habits can only be observed on birds in a state of liberty, and in their own country at that; but nevertheless, many very interesting hints may be gleaned from the study of birds not so situated, and these may always be checked by the study of their recorded habits in a natural state. Where such records do not exist, the study of captive birds is a useful stimulus to field observers to take up the matter, and often an observation on a tame or captive bird brings out a point which the field observer almost necessarily overlooks, owing, in many cases, to want of opportunity to discriminate between individuals—a point which will become evident later on.

The best of all birds for observation are, of course, those which live in a tame but free state in their own country, such as Wood-Pigeons in London, and House-Crows (*Corvus splendens*) in Indian towns, though even here the difficulty of identifying individuals is a drawback. The growing practice of ringing birds, however, which is proving so useful in throwing light on problems of migration, will probably be of service in making records of individual birds in the near future, and in this connection it is worth noting that spring net-traps can be obtained in which many species of birds can be readily captured without injury for this purpose.

In considering the habits of birds we have to realize that they fall into two categories, which may perhaps be called major and minor habits, or perhaps, habits and customs. By major habits I mean the leading and conspicuous life-activities of a species; its food, manner of nesting, mode of association (solitary or gregarious), etc. On these its life obviously depends, and to them its structure is often plainly adapted. Yet, as its life depends on the adjustment of its main activities to its surroundings, it is just these habits that are particularly liable to vary even in a state of nature, and especially so under the influence of man's interference, direct or otherwise. Habits of this sort are fairly, though not completely known in the case of a vast number of birds, but will always require study, as they are so subject to modification by circumstances.

The minor habits, or mannerisms as we should

call them in the case of persons, are not nearly so familiar, and have not been worked out fully even in many very well-known birds. Such are peculiarities in gait, flight, and other actions; attitudes under emotion, positions assumed in repose, etc. Often these have no apparent connection with any necessity, and they are practically invariable for the species and often for the group, and not alterable by circumstances.

To take a concrete instance; the common Sparrow, as every one knows, eats seed, for the cracking of which its bill is specially adapted; it perches in trees, and has feet adapted for grasping twigs; it also builds its nest in trees, and associates in pairs and flocks. These are its major habits, and every one knows they are subject to modification; it eats many things besides seed, especially remnants of man's food; it builds under eaves as well as among boughs, and will sleep in its nest or in a crevice of a wall, as well as on a twig, in spite of its grasping feet. In spite of its short wings, it chases insects in the air, and hovers and drops on them in long grass like a miniature Kestrel.

In other words, its major activities are, though to some extent correlated with its structure, highly variable, and this, no doubt, is one great reason for its success as a species. If actively interfered with by man it can vary still more; a hand-reared Sparrow has been known to acquire a Linnet's or Canary's song.

In some points, however, the Sparrow is invari-

able; it never acquires the habit of holding down its food with one foot, though this would be of vital importance to it in enabling it to consume large articles of food when perched on a small bough, and thus escape risk of ground enemies. Though largely a ground-feeder, it hops and does not run, and does not hold up its tail to keep it clear of wet; when courting it has a definite display, with wings lowered and head and tail raised. It rolls in dust as well as washing, a combination of habits rare among birds, and when scratching itself it lowers its wing and raises its foot over it. Some of these minor habits may have significance, but this is not obvious; what is obvious is that they are common to all Sparrows, and are often group-characters; thus, all the vast group of generally small birds—the Passerines, of which the Sparrow (*Passer*) is type and name-father — seem to drop a wing when scratching. Habits of this kind do not alter even in captive birds, although they may learn strange habits of feeding and nesting, and even alien songs.

Hence such characters are often useful in classification, just as anatomical characters or inconspicuous external ones are of more importance than the general contour. Thus, all anatomists of late years have impressed upon us that the Swallows and Swifts must not be considered near relatives because of their similar forms—long-winged, small-footed, and short-billed—since these may be accounted for by adaptation to a similar life spent in

chasing flying insects, and the anatomical characters of the Swifts differ from those of the Swallows, which present no important internal differences from the ordinary small passerine birds. There are small differences also in external characters which are not to be correlated with modes of living; the Swifts have but ten tail-feathers to the Swallows' twelve, and have not the scales on their shanks which are usual in birds. There is also a conspicuous difference in habit which seems to have no relation to utility, and hence is more likely to be a family character; in flight the Swallow every now and then draws in its wings to its sides—it still shows a sign of the typical small passerine bird's flight with its occasional dips with closed wings—while the Swift always keeps its wings fully expanded, whether skimming motionless or renewing its impetus by means of wing-beats.

Small details of habit are thus always worth observing, as they may be more significant than they seem, and in any case are good practice in observation.

Some pitfalls in observation or in drawing conclusions from the same need mentioning in conclusion. The danger of the major habits becoming modified in captivity or domestication has been alluded to, and is, indeed, made rather too much of by some writers; still, it is well to bear it in mind. There is also the difficulty of the field observer in discriminating between individuals—often between the sexes, when these are alike. One must never

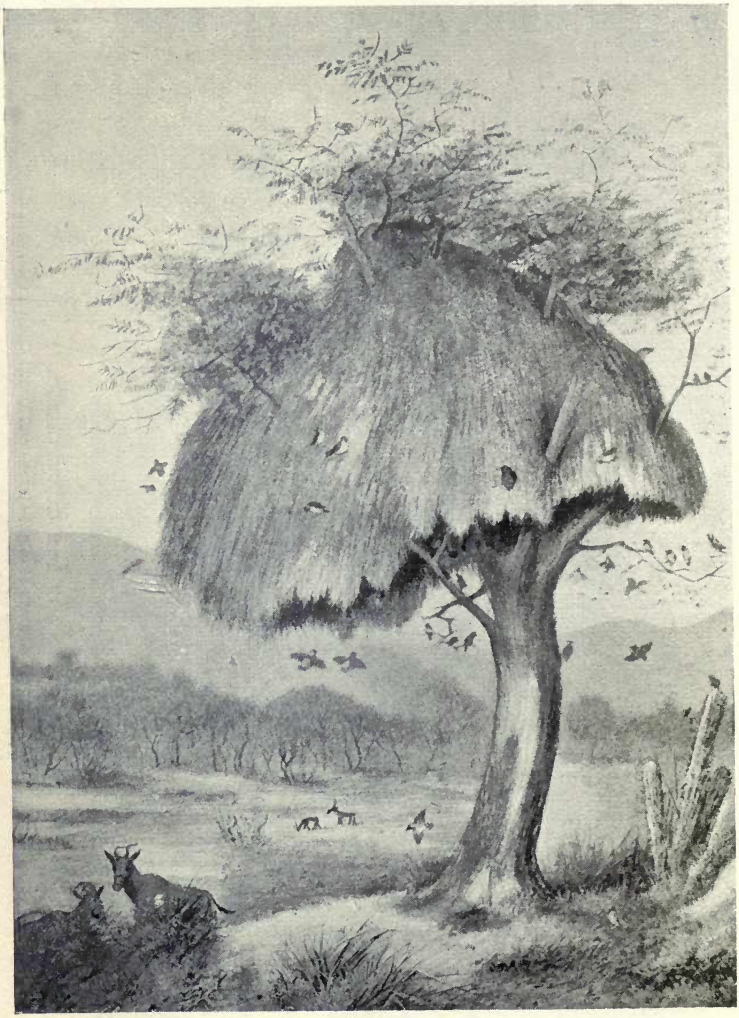
assume anything; if a bird is displaying, it is not necessarily a male, for instance. Quite apart from the fact that in many species the hen is the dominant sex, as in Phalaropes and Cassowaries, the hen may display even in those in which the male is well differentiated and very self-assertive; thus, I have seen a Peahen display to a Peacock, and a hen Turkey to the gobbler, these males in both cases remaining passive, so that had the sexes been alike, one would certainly have been tempted to draw very false conclusions about their behaviour.

Then one must be very cautious in keeping free from prepossessions; it is quite easy to see what is not there, if one has some image already in one's mind. We laugh at the error of the old naturalists who credited the Osprey, as a fishing-bird-of-prey, with one taloned foot and one webbed one; these odd extremities no doubt seemed to them appropriate, but I have seen almost equally gross instances of faulty observation of points of form and colour in the work of modern naturalists of the best repute.

Such errors can, of course, easily be checked, but when it comes to actions, unless the camera is at hand for the recording of such (which can be but rarely the case), the evidence is necessarily dependent on a number of witnesses. Every one is liable to err, and any observer is liable to have the opportunity of observing an action or occurrence which is rare or strange, and will be disbelieved until some one else arises to confirm it.

THE BIRD-COLONY IN THE CALCUTTA ZOO.

This colony was composed of about equal numbers of Night-Herons and Dwarf Cormorants, with a few pairs of Darters.



NEST OF SOCIABLE WEAVER-BIRDS.

"Republican Grosbeak" was the old name for this Weaver, which is a plain-plumaged, Sparrow-like bird.

One should thus be very careful in discrediting the observations of others if they do not happen to agree with one's own, especially if such were recorded many years ago; a record is not necessarily bad because it is ancient, nor good because it is new. Even one's own observations may contradict each other at times, as happened to me in my experience of our wild colony of the small Indian Cormorant (*Phalacrocorax javanicus*) in the Calcutta Zoo. These birds came in the evenings to their roosting-place on a wooded island in a large pond, and usually swooped down, Swallow-fashion, to take a drink on the wing before going up to roost. This was an unusual feat for a Cormorant to perform (although it must be remembered that this species is a light-built, long-tailed bird of only the size of a Teal), and, from the way in which the birds began to gape before touching the water, and often involuntarily checked their way so much that they had to settle after all, they evidently found it a difficult one. It so happened, too, that once for some time they gave the habit up, and settled in flocks in the water to drink in the normal way, though they afterwards resumed the custom of the flying sip; and I can well imagine that any one who had seen them thus drink sitting would put down my record of the flying drink as most far-fetched and out of all congruity with the structure and habits of a Cormorant.

Very likely the birds had adopted a really new habit, in drinking flying; at any rate, we know

new habits do occur—I rather fancy that I dropped across one of late, in finding the Sparrows peeling off the inner bark of the limes for nesting-material, even when they could easily get straw, and I find the habit not uncommon in the Regent's Park district, as many barked branches testify.

There is, therefore, always room for observation, confirmatory or original, and no conscientious observer need fear to record what he or she sees, for there is no such thing as authority in science, and the veriest beginner may often put the expert to the blush.

CHAPTER II

The locomotion of birds—Hopping and walking—Reasons for adoption of these gaits—Why Waterfowl waddle—Swimming and diving—Perching and climbing—Different methods of performing these actions—Specialized birds which have taken to different habits, as Ground-Parrots and Land-Geese—Flight and its varieties—Characteristic methods according to group and size—Sailing and soaring flight—Speed.

So old an author as Pliny gives some remarks on the locomotion of birds, many of them quite accurate, as when he points out that Crows walk and Sparrows and Blackbirds hop. Such differences in action are well known to most people, but it is just as well to have them summarized.

The usual gait of birds is a walk, that is to say, when they are considered by groups; it is true the majority of small birds one sees are hoppers, but that is because the common small birds of most parts of the world are passerines, and in this group hopping is the usual gait, walking being customary only in some of the larger species, such as Crows, and in groups which, like Crows, habitually seek food or even live on the ground, such as Wagtails,

Pipits, Larks, and Starlings. As passerine birds are all primarily adapted for a life in trees, even the Larks still having a typical percher's foot, and as jumping from bough to bough is a natural and habitual movement, it seems natural that this should be continued in all except those most thoroughly adapted to a ground life.

The same reasoning applies to the Hornbills, among which family are to be found the only large birds which hop; there are two species of this usually very short-legged and highly arboreal family which have legs of the ordinary length and live mostly on the ground, the Ground-Hornbills (*Bucorax*), and these move their legs alternately in the ordinary walking fashion and are even able to run well, which some walking birds do not do—most Herons and Storks, for instance. In the case of these Hornbills, it is to be noted that the hind toe is just as well developed as in the perching kinds, and that they walk on the end joints of the toes, the ball of the foot being raised above the ground, so that one could put a marble under it. This would be unique among birds, which usually tread on the whole under-surface of the toes, where these are on the same level—*i.e.* the hind toe not set on higher—were it not for the case of the Ostrich, which lifts the basal joints of its two toes off the ground even more, so that its foot can fairly be said to have a pastern-joint, like that of the hoofed beasts with which it habitually grazes. In the Ostrich reduction of the toes is carried to an

extreme, but in most running birds the hind toe is absent or greatly reduced, and useless, so that the case of the Ground-Hornbills, Larks, Desert-Choughs (*Podoces*), and other running members of perching groups is unique, as they alone of all running creatures have the bearing-surface of the foot well developed behind as well as in front.

Unfortunately for our explanation, the Hornbills and passerines do not exhaust the list of groups of birds in which some members run and others hop; and in the other cases it is difficult to assign a reason for the difference of gait. Pigeons, except some (not all) of the most terrestrial kinds, are all short-legged, and most live largely in trees, but they nearly all walk, although some of the most arboreal Fruit-Pigeons do hop as well; I have seen this most in the Lilac-crowned Fruit-Pigeon (*Ptilopus coronulatus*). Parrots, again, are mostly tree-birds, and all short-legged, some very much so, but they generally walk, although the Lories form an exception by hopping. Kingfishers do not move on their feet at all if they can help it, and all without exception are very short on the leg; yet the great Australian Laughing Jackass, which is more of a ground-feeder than any other, is a hopper, while the few others I have been able to study all walk, or rather waddle. So do Bee-eaters, at least the Australian and European species (*Merops ornatus* and *M. apiaster*); but of two Indian kinds of Nightjars I have seen one walk and the other hop, and the only Trogon (*Prionotelus temnurus*) whose

gait I have ever studied, hopped; and all these birds are short-legged. The shortest-legged Passerines, too, are the Swallows, but these walk when on the ground instead of hopping. Among Cuckoos and Rollers, the practice is more rational, so to speak, for the short-legged species hop, while the longer-legged Ground-Rollers and the magpie-like Bush-Cuckoos, like the Indian Crow-Pheasant (*Centropus sinensis*), run. Toucans, Barbets, and Woodpeckers all seem to hop, and this about exhausts the list of hopping birds, all of which, it will be noticed, are essentially perchers, so that hopping undoubtedly has something to do with the perching habit.

Walking-birds, however, may hop when in a hurry, as one may see with Rooks, Starlings, and even Wood-Pigeons, while birds of prey, which normally walk, though but little, hop so readily when "cornered" by a broken wing as to have given rise to the notion that hopping is their natural gait. Conversely hopping birds of the Thrush tribe often take a run for a few feet. Waterfowl have a bad name for clumsiness in walking, and certainly some of the more specialized kinds waddle awkwardly on account of the wide distance between their legs, which is convenient for swimming, but necessarily produces a rolling gait. This also badly handicaps them in perching, which so many of them do, especially in hot climates, for they find it difficult to walk along a small bough; and in the case of the perching Ducks, the dwarfed hind-toe is of no use for a grip, so much so that I have seen such active species as

the Mandarin Duck and Andaman Teal (*Nettium albigulare*) slide right over and off a perch on which they had tried to alight. Only Cormorants and Darters among waterfowl seem at all at home in trees, and these have a powerful gripping foot with well-developed hind-toe, and more freedom in the legs than is usual in diving birds.

In travelling along a perch, the most active, as well as the clumsiest perchers, are apt to move sideways; thus the lively Sparrow and the heavy Cormorant both sidle on a bough, though the ground-living Fowl and the arboreal Parrot walk foot over foot, for which the in-turned feet of the latter are particularly suitable. The most active birds at this pole-walking are the Guans and the Touracous, which run along boughs like squirrels, and at the same time can leap long distances from one perch to another; but on the whole, the more active the bird, the more apt it is to adopt the sidelong gait on a bough, often turning round with each hop, a method of procedure which seems calculated to make it giddy.

In climbing, several methods are employed; Parrots, as every one has seen, hook themselves along with their beaks as well as their claws, though they do not do this in the wild state as much as one would think from seeing them caged; and Crossbills, those Parrot-like Finches, climb in the same way. Woodpeckers and typical Creepers, however, climb quite differently from Parrots, but like each other, though the last group are Passerines and not

related to the former; both hop upwards or sideways on boughs and trunks, resting on their stiff-pointed tails, and letting themselves slip back if, which is seldom the case, they want to descend. The Nuthatch, which is not stiff-tailed, has the advantage of these extreme specialists in being able to climb in any direction, down as well as up.

Swimming is generally performed by alternate strokes of the feet when the bird is on the surface, and simultaneous strokes when it dives; but Auks, though they swim like other birds on the surface, propel themselves when below with their half-closed wings, and the Penguins never use their feet in the water at all, apparently, but rely entirely, both on and under the surface, on their flipper-like wings. Land-birds can generally swim if they are put to it, those which run swimming with their legs—I have seen a young Peacock thus save himself; those which rely on their wings will flap themselves ashore, which I have seen a Swallow do after it had fallen in; but they soon become draggled and exhausted, and except for the large flightless runners, cannot go any distance, in spite of being unable to sink. The giant runners, however, are as strong swimmers as beasts. I have known of a Cassowary making land after a four miles' swim in a by no means calm sea. Land-birds when swimming sink low in the water, but, curiously enough, so do some of the most specialized divers; the Cormorants swim with the tail awash, and the allied Darters only show the

head and long neck above water, most amply justifying the name of Snake-bird given to the Indian species.

It is curious to note how one finds some swimming birds completely deserting the water, and taking to a land life, though still retaining nearly complete webs to the feet; for instance, the Australian Cereopsis Goose (*Cereopsis novæ-hollandiæ*) seems never to go into water except to wash, or to escape when wounded, and the Hawaiian Goose (*Nesochen sandvicensis*), which lives on the old lava-flows in the mountains of its native islands, exists, during most of the year at any rate, without any water at all, even for drinking, getting the needful moisture from its food of berries and succulent herbs like sow-thistle. Conversely, we have, in the Dippers or Water-Ousels, Thrushes with ordinary perching feet which swim and dive.

So also one may find the Parrots, so peculiarly adapted for a life in trees, keeping not only to ground life like Partridges in the case of the Australian Ground-Parrakeet (*Pezoporus formosus*) and Night-Parrakeet (*Geopsittacus occidentalis*), but even waxing fat and losing the power of flight, in the case of the New Zealand Kakapo or Owl-Parrot (*Stringops habroptilus*), which looks like a gigantic degenerate form of the last. And among Cuckoos, birds also specialized mostly for tree-life, we have the swiftest runner of all birds in the American Road-runner or Chaparral-cock (*Geococcyx mexicanus*), which is only about the size of a Magpie, and yet

can run for hundreds of yards ahead of a horse or dog, being thus proportionately swifter than the Ostrich. It is curious, by the way, that no hopping bird attains high speed or power of long-distance travelling on foot, although, judging from what Kangaroos and Jerboas can do in this way, one certainly would have expected this to happen.

In the flight of birds there is of course less possible variation than in their movements on land and trees, or in water, but still there are some very characteristic differences. What may be called the normal or usual flight is by continuous strokes, as is usual in Pigeons, and universal in the Duck tribe; but this progression may be interrupted either by sailing intervals, both by slow-flapping birds like the Gannet, or quick-whirring ones like the Partridge; or by closing the wings and so dropping, to rise again with a fresh flutter, which is the usual method in Passerine birds, Woodpeckers, and Barbets, all tree-birds or relatives of such, be it noted, and most of them small, so that the method is probably adopted to gain impetus: just as many birds, such as Ducks and Parrots, roll much in their flight, apparently to put a "screw" on to themselves and increase pace. In the Hoopoe the flap and closure of the wings alternate so quickly that the bird looks just like a big butterfly.

The resemblance of many Parrots to wildfowl in their flight is indeed curious; both groups stretch out their necks in front and their feet behind, although this backward extension of the feet was

supposed to be a speciality of the long-legged waders, the extended limbs acting as a rudder. But as a matter of fact the extension of the legs behind in flight is normal among birds generally, the only groups that draw up their legs to the breast being Passerines, Woodpeckers, Barbets, and Hoopoes, all undulating flyers.

The extension of the neck is also normal in many groups, but Passerines, Hoopoes, Rollers, birds of prey, Herons, Pelicans, Frigate-Birds, Petrels, Gulls, Shore-Birds, and the Carrion-Storks (*Leptoptilus*) draw it in, so that here there is more latitude allowed, so to speak. The finest flyers of all seem generally to favour the drawn-in neck, at any rate that is the pose with Eagles, Vultures, and Albatrosses, whose powers of maintaining flight for long periods together without movement of the wings have always evoked admiration, and still remain unexplained. Albatrosses have narrow though very long wings, and usually fly low; the overland soarers have shorter but very broad wings, and only sail when flying high. Both groups, however, are noticeably large birds; small birds of any groups, no matter how well-winged, never soar or sail very far. This may be due to the need for weight to give steadiness, but it is at least quite as likely that it is connected with the more lively disposition of small species, and with their habit and need of picking up their food in small bits at frequent intervals, so that they never have either the time or inclination for soaring.

In respect of the activities of the soaring birds of prey, it has been noted that the highest soarers are the latest to rise, the Vultures not taking the sky till after the Kites, and none soaring till the sun is well up, and it has been suggested that sun-lit air has some favourable influence on soaring. Even over here I have observed that a fine, sunny day in winter or early spring will set the Black-headed Gulls on the Thames soaring, but I always put this down to their being inspired by the fine weather with thoughts of their home breeding-grounds, and a preparation for travelling thither; while I should have said that the connection between sun and soaring in the East was simply that the larger carrion-feeders needed clearer air, and had to mount higher, as their food was harder to find; but after an absence of a dozen years from India I am quite willing to admit I may be mistaken. However, sunny weather in autumn does not seem to take the Gulls aloft, as I have had an opportunity of observing recently.

It is noticeable that soaring birds are never still, but keep on describing circles as they float on extended motionless wings; as a matter of fact they appear to descend a little and then use the impetus thus gained to rise again, so that they are really making spirals. A bird, except in a strong wind, can only stand still in the air by constant and rapid wing-action; this is the feat of hovering, of which the Kestrel is the most familiar exponent in this country during most of the year, though the

Sparrow frequently practises the trick over long grass in summer in order to locate insect prey. The Kingfisher also frequently hovers, when a handy perch to swoop from is not available, and in India the Pied Kingfisher is the most familiar of hovering birds, this species seeming always to make its survey of the fishing-ground on the wing.

Hoverers of the more skilled types raise and lower themselves with great ease and skill, such flying reaching its perfection in the Humming-birds, which almost invariably hover when feeding, and dart sideways or even backwards as unconcernedly as dragon-flies. They seem indeed to represent these insects in the bird world, for like them they are no pedestrians, only using their feet for perching or clinging, since if any bird is unable to progress on the ground it would appear to be these, and they seldom shift their position even when perched.

In conformity with their insect-like flight, the wings of the Humming-birds are much like those of insects in shape, the segments of the arm between the pinion and the body being much reduced, so that there is little action except from the shoulder. Not all of them, however, move their wings with the insect-like quickness which in the small kinds results in the hum that gives these truly fairy creatures their name, for the largest species (*Patagona gigas*), which is as big as a Swift, flaps its wings at an ordinary rate of speed and quite visibly. The slowing of the wing-stroke in accordance with increase of size seems to be a general rule in birds,

always supposing those of the same family are compared; thus the common Grey Heron flaps in a very leisurely way, while the little Dwarf Bitterns (*Ardetta*) use a quick fluttering stroke like a Moorhen, and the slow heavy sweeps of the Goose contrast forcibly with the quick wing-beats of the Duck.

Comparing a Duck and a Heron of about the same size, however, the Duck will be found to move its wings more quickly, the Ducks being a quick-action family as a whole, and the Herons a slow one. This makes the comparatively quick action of the small Herons interesting, as the wings in all this family are large for the weight of the very light body, so that we must not suppose that quick wing-action is always connected with small wing-area, though this is often the case, as in such birds as Auks, where the wing has been reduced, to serve also as an oar, to the minimum size consistent with flight. The Great Auk went further—and fared worse, for when man came upon the scene some time in the Stone Age, it began to discover the disadvantages of turning its pinions completely into paddles.

The great soaring and sailing birds also find they "cannot have it both ways"; they are adepts at saving their petrol, so to speak, and this is a point which aviators would do well to study, as it would be of great advantage if they could circle by the hour without using their engines; but they are bad and heavy starters, rising at a low angle and

with great effort. This is particularly the case with the Albatrosses, which have sacrificed muscular power to gliding capacity, and elongated and narrowed their wings, to a very risky extent.

On the Australian coast there is a valley ending in a cliff-wall which is a regular death-trap for the local Albatrosses which pass over it on their way home to a breeding-ground. If, when coasting over this hollow, they dip between the walls, they lose the wind, begin to drop, and not having sufficient strength of wing-beat to "get up steam" in the limited space in front of them, end by colliding with the cliff at the end of the gully, when they fall to the ground to die a lingering death from hunger, for the walls of the valley are too steep for them to climb, and they have not enough intelligence and enterprise to explore a cave at the cliff-foot which would lead them out into the open again.

Another example of the dangers of over-development of wings is to be found in the appropriate fate of hanging that now and then befalls the piratical Frigate-bird in the West Indies, as described by Dr. P. Lowe; this species, like so many tropical waterfowl, frequents trees, but may easily miss its footing when alighting and slip down among the twigs, where its great wings cannot have full play, and it is exceedingly likely to catch its neck in a fork, when its very much reduced feet are of little use in its attempts to extricate itself, and it soon perishes.

The Frigate-bird is, however, a better starter than the Albatross, being able to "take off" at once. The easiest of all starters are the Gulls, for they can spring up from a sitting position if they like, without troubling to rise to their feet. When Swifts start off the ground, they seem to "take off" with their wings, like Bats when similarly situated; the idea that they cannot thus rise is certainly erroneous so far as the common House-Swift of India (*Cypselus affinis*) is concerned, as I have proved by repeated experiments. With regard to the power of springing up vertically at the start, the Game-birds are unrivalled, on account of their muscular power both in legs and wings.

The best settlers seem to be the Hawks; it is delightful to observe one of these birds just glide up to a perch and touch it at exactly the right moment, no final flapping being required; such accuracy of action being no doubt a necessary accomplishment in birds which have to grasp food when in flight and avoid injuring themselves by concussion in so doing. But such skill has to be acquired with practice; I have seen a young Kite in India plunge up to its belly in a pond when picking up an object which an old one would have skimmed off with hardly a ripple. As a contrast to the skill of the Hawks, we may take the awkwardness of the Grebes, which trail their legs even when alighting and strike the water anyhow.

I am sorry I never noted what, if any, difference there is between young and old Kites in the matter

of soaring ability; but Buller, in his "Birds of New Zealand," mentions that the immature specimens of the very common Harrier of that country (*Circus gouldi*), which are more conspicuously different in colour from the adults than are the young Indian Kites, do not soar as the old ones do, so that they are often taken for a different species of Hawk altogether.

In very rare instances young birds may even fly better than adults; this is the case, according to Mr. W. H. Hudson, with the common Tinamous of Argentina; and in that very curious bird the great grey Steamer-Duck of the coasts of southern South America (*Micropterus cinereus*), only the younger individuals seem to be able to fly at all, the older birds becoming so heavy that their small wings simply serve to support and assist them when running on the surface of the water, a curious quadrupedal mode of locomotion which has attracted the attention of all observers, but seems only to have been fully and exactly described by Mr. M. Nicoll in his admirable work on his experiences as a naturalist in the cruises of the Earl of Crawford's yacht the *Valhalla*. So fast can these huge Ducks "steam" along, he tells us, that a six-oared boat cannot overtake them or even come within shot.

Quadrupedal locomotion on land is found in the case of the Penguins, which when pressed will use their flipper-wings as fore-legs, the species which inhabit snowy regions tobogganing along most effectually in this way. As we shall see later, also,

some young birds, even among those of our own country, employ quadrupedal locomotion.

With regard to the speed of birds in flight, some very "tall" statements, especially of German manufacture, have been circulated; for there is a strong tendency to exaggeration about this point. Before steam-engines came in, the speed of birds' flight could not be so well estimated as it can now; as Newton justly remarks in his famous "Dictionary of Birds," the Swallow does not usually travel so fast as an ordinary express train; and yet this bird is proverbial for swiftness. The speed of the common Pigeon is also well known owing to the popularity of Pigeon-races, and these show that it is a good Pigeon that can do its fifty miles an hour; while the most ordinary observation shows that the Pigeon, though not nearly equal in swiftness to the Swallow, is yet much faster than the majority of birds.

The speed of small birds tends to be exaggerated, owing no doubt to the quickness with which they move their wings; thus, Common Teal are credited with being the fastest of Ducks by some writers, but this can hardly be the case, for in India the Shoveller, and even the heavy Spotted-billed Duck (*Anas pœcilorhyncha*)—the Mallard of India—have been recorded as leading a bunch of Teal; and in America a flock of the very closely allied Green-winged Teal (*Nettium carolinense*) have been seen so hard pressed by the apparently slow-flying White-headed Eagle that they had in desperation

to drop into the water headlong, a common manœuvre with Ducks when a pursuer's speed is too much for them.

The slow-flapping flight of large birds as compared with their more briskly moving relatives in the same family has long been recognized by sportsmen as very deceptive; wild Swans, Capercailzie, and wild Peafowl are all birds which need the shot to be aimed well forward if they are to be fatally hit, their flight being so very much faster than it looks, especially to a shooter who has been used to smaller fry.

The fastest birds of all appear to be, as one would expect, some of the Swifts, the palm among these being assigned by Blanford, in the "Fauna of British India," to the larger species of Spine-tails (*Chætura*), which are stated by observers to whizz by with a twang like a bowstring. It is noticeable that the spiny-tipped tail in these birds, which, like the similarly armed tail of most Woodpeckers and Creepers, serves as a support when the owner is clinging perpendicularly, is so short that it cannot be of much use in directing their flight, and in fact the Swifts generally, though better flyers than Swallows, distinctly tend to be shorter in the tail, and often dispense with the fork.

In fact, the opposite development of the tail in birds which fly well is very curious, some fine flyers having a long forked tail, like Swallows, Terns, and Frigate-birds, while others, like the above-mentioned Swifts, most Albatrosses and Vultures,

and that aerial acrobat the Bateleur Eagle (*Helotarsus ecaudatus*) seem to have gone in for tail-reduction, so that the steerage, etc., is evidently given over entirely to the wings in their case. The steering action of the tail is particularly observable in Kites, in which that member is often turned almost into a vertical plane, and this characteristic action was noted by the ancient Romans, Pliny suggesting that it was the Kite that taught men the use of a rudder to a ship.

Generally speaking, however, the most important use of the tail is as a brake when descending; why it is always expanded at starting is not so obvious, and probably the action is an involuntary one, like the dropping of the legs by Gulls and Crows when they check in their flight, a habit which has led some observers into the mistaken idea that Crows, when picking food off water, do so with their feet, which is never the case so far as I have observed.

Mere speed of flight, by the way, is not necessarily so indispensable an asset for escaping aerial enemies as may be supposed; Swallows and Swifts certainly suffer little from birds of prey, the Hobby being the only Falcon which ordinarily catches them, and the swift Sand-Grouse, among ground-birds, are too much for most Falcons. But some quite slow birds are also very difficult subjects for Hawks, owing to the facility with which they shift from the stroke, the Hoopoe and Lapwing being notorious for their abilities in this respect;

while as to the slow-flying Grass-Owl of the East (*Strix candida*), a near relative of the Barn-Owl, Indian falconers say it is one of the birds which "will show you the stars," in allusion to its habit of "ringing up" and thus escaping the pursuit of their Falcons.

The flight of various birds, indeed, admirably bears out the old "horsy" proverb, "They run in all shapes"; one often cannot at all predict what a bird's flight will be like from looking at a dead or caged specimen. Terns, for instance, are so Swallow-like in build that they are often and quite reasonably called sea-swallows, but their flight is not at all Swallow-like, though recognizably like that of their family relatives, the Gulls. Tropic-birds (*Phaethon*) look very like Terns, and feed in the same way, but their flight is not at all like that of a Tern, but is performed with quick wing-beats, like that of a Duck.

It thus differs much from that of all other long-winged sea-fowl, but much resembles that of the swift-flying Ring-necked Parrakeets (*Palæornis*); and it is curious that the Tropic-bird has the long pointed tail one usually associates with a Parrakeet. Generally this wedge-shaped tail is favoured more by ground-birds like the Pheasant than by fine flyers, but besides the Tropic-birds, the Skuas also possess it, and they are experts, being able in the course of their piratical profession to fly down the Terns, which have the forked tail usually associated with dexterous flight, and very seldom found in

ground-birds, the Blackcock being the best-known exception.

Short-winged birds may display a quite unexpected power of flight; thus the Jay flaps along with slow beats like its far longer-winged relative the Crow, can fly fast if it likes, or swoop in an almost Hawk-like way, and often crosses the North Sea on migration. On the other hand, birds with large long wings may be, in rare cases, very poor flyers, as in the case of the Secretary-bird of Africa, this strange pedestrian Eagle having so neglected its wings that its flight, although of Eagle-like stateliness, is very weak, and the bird can even be run down by greyhounds, just as the short-winged heavy Wild Turkey is.

There are stories of Great Bustards being coursed by greyhounds, and Xenophon says positively that in the historic retreat of the Ten Thousand the Greeks rode them down, "for they fly only a short distance like Partridges, and soon give in." It seems to me quite possible that this Bustard was in former times on the way to degenerating into the state of the Steamer-Duck above mentioned, and that increasing persecution by man has simply eliminated degenerate individuals, as the bird is now a strong flyer and goes long distances.

CHAPTER III

The nutrition of birds—Various kinds of food, animal and vegetable—Methods of and adaptations for obtaining it—Changes of diet—Gluttony of some species—Power of discrimination among foods, both vegetable and animal—The much-discussed relations of birds to insects, especially butterflies.

"WORMS and flies," mentioned by Shakespeare in *Macbeth* as the food of birds, are certainly the staple of the large majority of the class, at any rate if we take both terms in the wide old-fashioned sense, in which a worm meant anything long-shaped, and a fly almost any flying insect; for on small invertebrate life birds mostly depend, and even when the old birds are mainly or largely vegetarian, the young feed, or are fed by their parents, on animal food in perhaps the majority of cases.

This diet is probably ancestral, for it is at least probable that the reptilian ancestors of birds were largely if not mainly animal-feeders, and thus the young only go back, as in so many cases in nature, to the early diet of the race. But just as even among the reptiles there are some mainly vegetarian kinds, such as some iguanas, the land-tortoises,

and some of the terrapins and turtles, so there are certain families of birds, and sub-groups of other families, which are mainly vegetarian in diet, as implied above. Some of these groups are large or important, and therefore well-known, such as Parrots, Pigeons, Game-birds, Finches, Cranes, and Geese; among small and less familiar groups of vegetable-eating proclivities are Ostriches and all the other giant flightless birds—Emus, Cassowaries, and Rheas, their relatives the Tinamous (the "Partridges" of South America), the Seed-Snipes (*Thinocorythidæ*), the Sand-Grouse, the Screamers (*Palamedeidæ*), and among the less familiar perchers the Touracous or Plantain-eaters (*Musophagidæ*), the Colies or Mouse-birds (*Coliidæ*), and the nectar-sucking Humming-birds.

Many if not all of these take more or less insect or other animal food as well; there seems to be no group of any size so purely addicted to vegetable food as certain of the animal-feeding families or groups are to an animal diet. Such pure animal feeders are especially to be found among those which take larger prey than insects, especially the fish-eaters; Gannets, Cormorants, Pelicans, and the Frigate- and Tropic-birds seem to be purely animal-feeders, though the Gulls, and even the oceanic Petrels, take some vegetable food.

The "birds of prey," as one would expect, are generally purely carnivorous or insectivorous, though some Vultures will eat fruit; the South-American Vultures feed on palm-fruits, and the Egyptian

Vulture will devour not only spoilt figs, as recorded by Tristram, but even despoil date-trees of their crop. So also among birds generally regarded as purely insectivorous, Swallows in North America are known to feed on the berry of the Wax-Myrtle (*Myrica cerifera*) in autumn, and among the worm-eating waders the Ruff and the Black-tailed Godwit eagerly devour rice and other grain, such as wheat and millet.

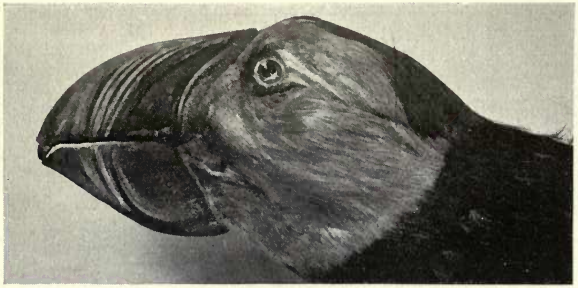
The Game-birds would perhaps be better regarded as omnivorous, like the Rails, and most fruit-eaters, like Toucans and Hornbills, eat small animals freely when they can catch them. The Barbets, which seem to be the unspecialized ancestors of the Toucans—if these really are a distinct family at all—show a curious contrast in habit according to their distribution, though all much alike in structure; the Asiatic species are mostly fruit-eaters, while the African and South American species are largely insectivorous. With the Trogons, which have an equally wide distribution and are still more alike structurally, matters are almost exactly the other way about; the old-world species, chiefly to be found in Asia, though one or two are African, being insectivorous, while the American kinds live mainly on berries, which they gather on the wing.

One interesting point comes out from this consideration of bird-diet, and that is, that the largest birds, and those which, as groups, display the finest plumage, are more or less vegetarian, while those whose power of flight is pre-eminent range them-

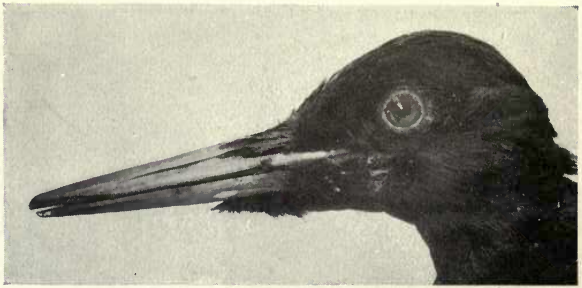
selves in the animal-feeding section; though it must be remembered also that a vast number of insectivorous or mixed feeders have weak powers of flight and very sedentary habits, such as the host of small insectivorous birds resident permanently in the tropics.

The majority of birds show little or no specialization for the purpose of food-getting; that is to say, one very generally cannot tell from the look of a bird whether it lives mainly on animal or vegetable food. For instance, Pigeons, as has been said above, are mainly vegetarian, and Plovers are chiefly worm- and insect-eaters; yet the bills of the two groups are singularly alike, and the vegetable-eating Cranes are so like the animal-feeding Storks and Herons that people who are not used to birds constantly confuse them with each other. Similarly, it is curious that the Parrots, some of the strictest vegetarians, have bills more like those of the very carnivorous Hawks and Owls than like those of any other birds; and when it comes to the hosts of passerine birds with the ordinary unspecialized type of beak, observation alone can tell what their diet is.

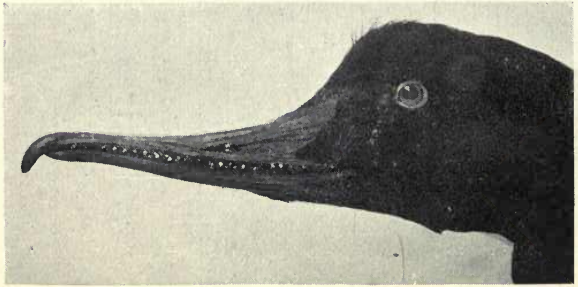
There are, however, plenty of well-known and conspicuous cases where structure and habit go closely together; to take a very familiar case, it is easy to see that the thick, short conical bill of a Finch is correlated with the habit of cracking seed-husks, and the long pouch-bearing bill of a Pelican is obviously especially adapted for catching fish.



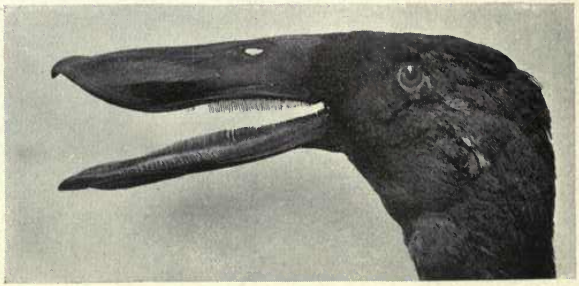
PUFFIN.
The huge size of bill is due to a horny mask, shed after breeding.



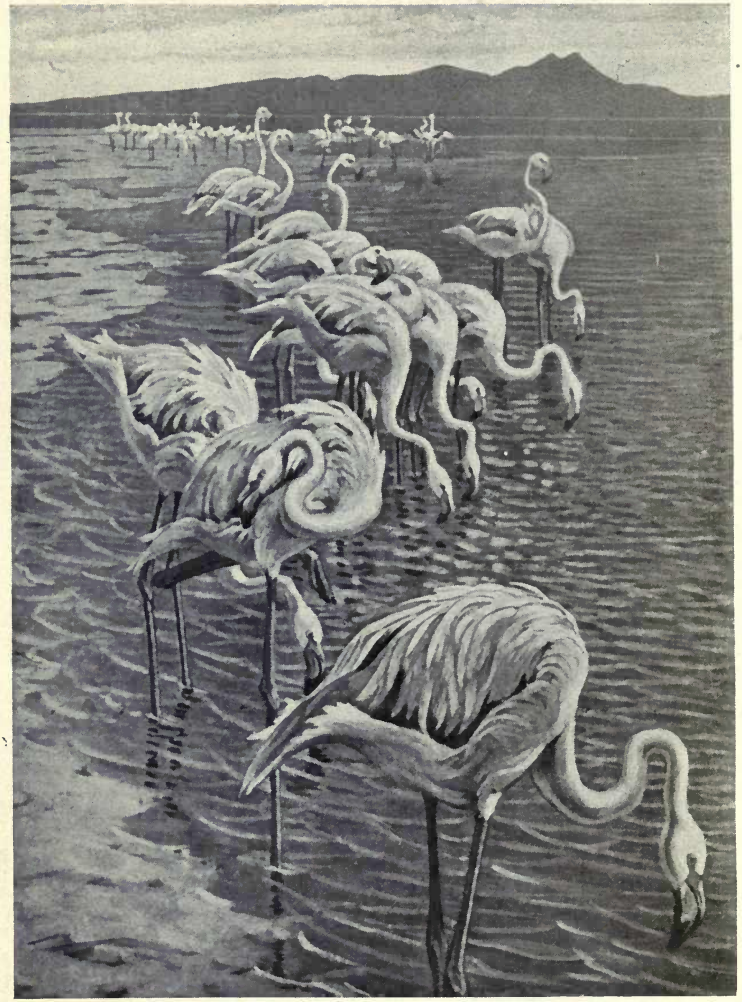
GREAT BLACK WOODPECKER.
Showing chisel-like form of bill for cutting wood.



MERGANSER.
Duck type of bill modified for catching fish, the jaws being narrow, with horny teeth.



SHOVELLER.
Extreme modification of duck type of bill, suitable for sifting only.



FLAMINGOES.

The species here represented is the Common Flamingo, the only one found in Europe ; it may generally be seen in the Bitter Lakes, by the Suez Canal.

[*By permission of the artist, Sir Harry Johnston, G.C.M.G.*

Few people, by the way, realize how a Pelican's bill works; it is not a fish-creel, but a dip-net; when the bird is fishing, the elastic branches of the lower jaw expand into a great skin-floored spoon, and scoop up the prey, contracting again when this is captured.

The beautiful sifting-arrangement of rows of horny plates along the bills of the typical Ducks is one that can easily be seen in action, and it serves for collecting not only animal but vegetable food from water or mud; in the grazing Geese and the fishing Mergansers the ridges take the form of teeth, since here biting rather than sifting is needed. The perfection of the sifting apparatus is, as Darwin pointed out, found in the bill of the Shoveller Duck, where the ridges almost equal in proportionate length the whalebone of some of the whales; and the Shoveller seems consequently to be able to extract nutriment from water in which the other Ducks find "bibbling" unprofitable.

The simplest form of the ridge-row is to be found, as might be expected, in the Magpie-Goose above noted, in which it is hardly more pronounced than the "burring," like that of the ends of a pair of forceps, to be found in the beak of the Emu. Nevertheless the Magpie-Goose "bibbles" like a Duck, and does so habitually, unlike the true grazing Geese, though these will use their grazing bills in this way occasionally; recently, in autumn, I saw no less than four species of Geese, the Common, Chinese, Canadian, and Bernicle, sifting in this

manner the water in the roadside gutters, filled with dead leaves, on a wet afternoon in Hyde Park. The Magpie-Goose, however, also grazes at times, but is particularly fond of digging and tearing with its bill at mud and roots, though I have so far not been able quite to make out what it gets when thus engaged.

It will be noticed that the Common Duck, with its specialized bill, keeps up the varied methods of feeding noted in this primitive-looking relative, though the Shoveller has practically become a sifter pure and simple. The diving Ducks, although having a sifting beak, seem to use it very little, for when one watches them feeding in clear water they seem to simply pick up their food from the bottom, darting hither and thither, and not working away in the same place. Small portions they can swallow below the surface, but have to come up with a large mouthful, such as a water-snail. Such molluscs form a large proportion of the food of Ducks and other water-birds, and land-shells, as all know, are eaten by land-birds, though generally these are small specimens which are eaten whole, the Song-Thrush being exceptional in its habit of dashing large specimens on stones in order to chip off their shells and prepare them for food.

There are several other kinds of specialized mollusc-eaters, notably the shell-eating Storks of the genus *Anastomus*, called "Open-bills" from the fact that their beaks gape in the middle in

adults; of these there is a black African species and a pied Asiatic one. These birds have a fringe of horny growths towards the tip of the beak, at any rate in adults (for they are absent in the young of the Asiatic kind); and this renders the peculiarity of the sifting structure of the Duck's bill being repeated in the Flamingoes of less value as an evidence of affinity.

Indeed, although many of the less-informed naturalists seem to regard the Flamingoes as simply Roman-nosed Ducks on stilts, anatomists find them to be more closely related to the Storks; and their bibbling performances, though similar in principle to those of the Ducks, are carried on with a curious difference in detail. In the Ducks the bill has the upper jaw far the larger, the lower fitting within it; in the Flamingoes the bill is constructed in just the opposite way—the lower jaw being so much deeper than the upper that the latter simply is to it as the lid of a box, or in some species shuts within its edges. Being also very freely moveable, it plays like the lower jaw of the Duck, and acts as such, for the Flamingo feeds with its bill upside down, as many must have observed at zoological gardens where these most interesting birds are kept.

Judging from their behaviour there, they can extract food from water which affords nothing to the Ducks—except perhaps Shovellers—and this, added to their habit of frequenting salt-lakes, avoided by most other birds, is no doubt a great asset in the struggle for existence to these unprolific

and very helpless creatures. Like Ducks, they eat both animal and vegetable food, and in captivity eat and thrive on such an unnatural diet as grain. In both Ducks and Flamingoes the sifting apparatus is found along the edges of both jaws, but in some of the Petrels there is found a similar structure for extracting food suspended in water which still more recalls that of the whalebone whales, in which the so-called " bone " (which is really horn) is confined to the upper jaw, by being similarly limited to the upper bill.

These Petrels, called Whale-birds by sailors, belong to the genus *Prion* of naturalists ; they are small birds about as big as Doves, of a pigeon-blue colour, and display a beautiful gradation from a bill which is quite ordinary except for the ridges visible in it when opened to one which is so bulged out at the sides, and has such long fringes, that the caricature of a whale's head is at once obvious. Yet the species are so closely related that it is quite difficult to separate them, so that here is evidently a case where evolution is comparatively recent and has not resulted in any decided differentiation.

To return to the subject of mollusc-eating birds, from which we have been led by the consideration of these fringed-billed birds, whose " dentition," if we may use the expression, is just as worthy of study as the true teeth of beasts or reptiles ; we find in the Oyster-Catchers (*Hæmatopus*) which, some pied like our own, and some black, haunt sea-coasts nearly everywhere, a special weapon for getting to

terms with shellfish in a very hard, chisel-tipped bill, strikingly different from the soft weak bills of the majority of the Snipe family (*Charadriidæ*) to which they so obviously belong by the rest of their structure. With this they can prise limpets off the rocks, and adroitly chisel out the meat of other shellfish, while at the same time the tool is an efficient weapon as well, like the axe in the hands of early man, and nest-robbing Gulls and Crows find the Oyster-Catcher's home a difficult proposition to tackle.

The most typical bills in the Snipe family have a beautiful adaptation to the "Diet of Worms"; in the Woodcock and other typical Snipes the bill is "overshot," that is to say, the upper jaw distinctly exceeds the lower in length, and has a knobbed tip somewhat like the end of a crochet-hook, behind which the lower jaw fits accurately, so that the bill can be driven into the mud or soft ground with ease. At the same time the bill is so soft and sensitive that when the bird has been dead a little time the end is seen to be pitted like a thimble by the shrinkage of the covering skin owing to the drying of the soft nerve-tissue within, and the upper jaw is so flexible that the bill will open at the tip and remain closed for the rest of its length. Thus it can grip a worm when felt without the necessity of being opened entirely, which would be a difficult matter for a bird of this size; the worm when seized is, so to speak, nibbled up, not dropped down the throat with a jerk of the uplifted

head, as is so often seen to be done in the feeding of long-billed birds. At the same time, so that the bird can keep a look about it when its bill is driven into the soil, the eyes are situated far back in the head, reminding one of the similar shifting back of the eyes in the most highly developed grazing beasts, such as horses and cattle, though here the necessity for deep-rooting molars is given as the reason.

Structure and function correspond very closely in the Snipe group ; for instance, the Common Snipe (*Scolopax gallinago*) and its East Asiatic ally the Pintail Snipe (*S. stenura*), which are exceedingly alike in size and plumage—the curious narrow feathers in the tail of the latter not being noticeable till looked for—can be quite easily separated by the difference in the bill, expanded at the tip in the common species, and of uniform calibre in the Pintail ; and their habits correspond, the Common Snipe being mainly a mud-feeder and worm-catcher, while the other often feeds on dry ground and has a more varied menu, including land-insects and land-shells to a great extent. Through the Sandpipers of different sorts a gradation can be traced from these specialized bills to the short pigeon-like ones of the Plovers, with their normally placed eyes. Yet these are also worm-eaters and borers to some extent, so that here, as in the case of the Duck tribe, we can trace the evolution of structure and habit most satisfactorily.

Two or three interesting little off-shoots of this

family of mudlarks need noticing. The Turnstone (*Strepsilas interpres*), well known on all coasts in the winter, is a thick-set little bird with a plain, short, straight, hard beak, in which the only noticeable point is the very straight profile. It is a beak which at first sight seems only suitable for ordinary pecking, and is often used for this, but the bird derives its name from the unusual habit of turning over stones and other objects in search of the creatures which shelter beneath them. Mr. Barnby Smith has recorded in the *Avicultural Magazine* his experiences with two captive birds of this species; these he found could turn over a weight of as much as half a pound, a big feat of strength for a bird not larger than a Song-Thrush, and Edwards, the well-known cobbler-naturalist of Banffshire, saw three combine to try to upset a dead cod-fish which was too heavy for one to manage alone.

An opposite case to that of this widely-ranging and versatile bird is found in the extraordinary little Wry-billed Plover of New Zealand (*Anarhynchus frontalis*), which is unique among birds in having its bill bent to the right side, an adaptation, it is said, to a habit of searching for food around stones, and always running in one direction; it is well figured, and its peculiarities described in the second edition of Buller's "Birds of New Zealand."

Then, among the very small Sandpipers known as Stints, we get the unique Spoon-billed Stint (*Eurynorhynchus pygmæus*) of Eastern Asia, a rare

bird with a bill expanded at the tip like a miniature Spoonbill's, and presumably used in much the same way, *i.e.* for sifting as a Duck does.

The true Spoonbills, by the way, are nearly related to the Ibises, and in India our British species, which is well known there, is called Spoon-Ibis (*Chamach Buza*)—a creditable tribute to the untaught native's discrimination in classification; our European ornithologists have generally put the Spoonbills in a family by themselves, though they are so near the curve-billed Ibises that a Spoonbill-Ibis hybrid was bred some years ago at the Berlin Zoo. The Curlews, which are so often confused with the Ibises, are simply large Sandpipers with the beak modified into the same bow-shaped form as that of an Ibis. The Curlews, however, simply probe for food, without the lateral sweeping action so noticeable in Ibises.

Curved or bowed bills are common among passerine birds, and are often employed in different ways; the use of such a bill as a probe is familiar in our tiny Tree-creeper (*Certhia familiaris*), which investigates the bark of trees by its aid; but there are also other Creepers with straight bills, and the group grades into the strong-billed Nuthatches, whose beaks are powerful hammers; a Nuthatch hews like a Woodpecker, and splits his nut with a powerful swing of the whole body from the hock, having first fixed the nut in a crevice to give a purchase and keep it steady.

Some of the social Thrush-like Babblers in the

East also have the bow-bill, and no doubt this is often used as a probe; but on keeping some specimens of the Rusty-cheeked Babbler (*Pomatorhinus erythrogenys*) in India in a small aviary with a deep bed of sand on the floor which had become hardened, I was astonished to find them vigorously using their long curved beaks as pick-axes, digging up the ground as if a corps of pigmy navvies had worked at it. The beak is evidently adapted for much wear and tear, as I found on buying these birds that in some it was much overgrown from want of use, and had to be cut back.

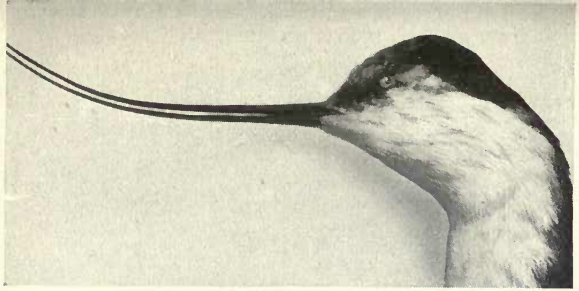
But the most remarkable beak found among insectivorous birds is that of the Huia of New Zealand (*Heteralocha acutirostris*); not so much from the peculiarity of the bill itself, as because of its different shape and use in the two sexes, a phenomenon unknown elsewhere among vertebrate animals, since, however different the sexes may be in general appearance, their means of obtaining food are practically identical. But in the Huia, although the plumage and size are identical in both sexes, the beaks are as different as those of a Woodpecker and a Tree-creeper, the male having a strong, straight digging bill of moderate length, and the hen a long, curved, slender, probing one, twice as long as her husband's pick-axe.

The late Sir Walter Buller, in his admirable book on the birds of New Zealand, tells us how he was able to study the actual use of their very diverse bills by these birds. He had a pair brought to

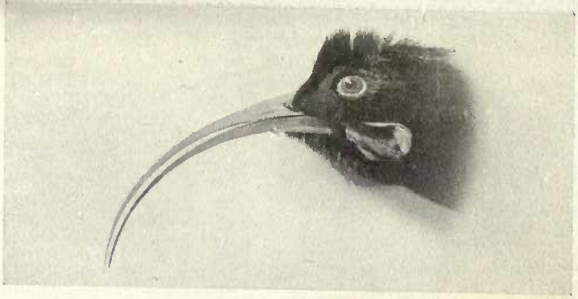
him by a Maori, and turned them loose into a small room. Here he provided them with decayed logs infested with the boring grubs of a beetle (*Prionoplus reticularis*), which forms an important part of the Huia's natural food. The birds were tame, and he could easily watch them at work—the male chiselling and hacking at the rotten wood, and the hen probing the beetle-burrows where this was too hard for him to cut it away. When, after pecking away at the wood, the male Huia still failed to reach his prey, the hen would come and pull it out with her longer forceps, but, although she had availed herself of his preliminary work, she always ate herself everything she thus got; behaviour apparently selfish, but, as we shall see later, quite normal among hen birds.

The two nevertheless were much attached to each other, and this seems the character of the species; there is even in Buller's book a figure of a hen Huia whose upper bill, by some accident or natural deformity, had grown into the shape of a corkscrew, so that it can hardly have got enough food to support life naturally (although the Huia eats berries as well as insects) and had evidently been fed for a long time by a devoted mate.

In this case the hen evidently has the more specialized and recent type of bill, and those of the young of both sexes resemble the male's; and curiously enough, New Zealand presents us with yet another case of female specialization in the case of the local species of Sheldrake (*Casarca variegata*)

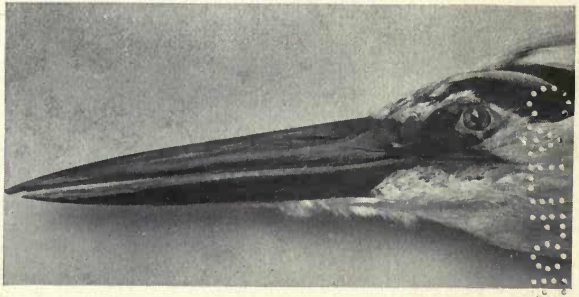


AVOCET.
Although the bill is so different, the Avocet feeds much like the Spoonbill.

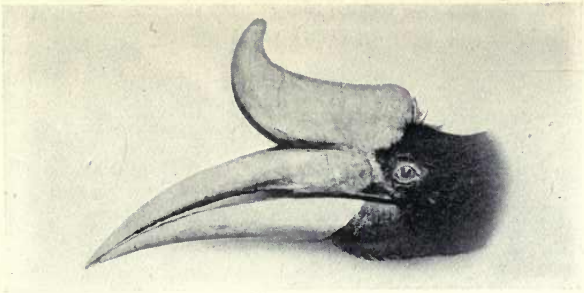


HUIA (FEMALE).
Showing the long Tree-creeper-like bill adapted for searching crevices.

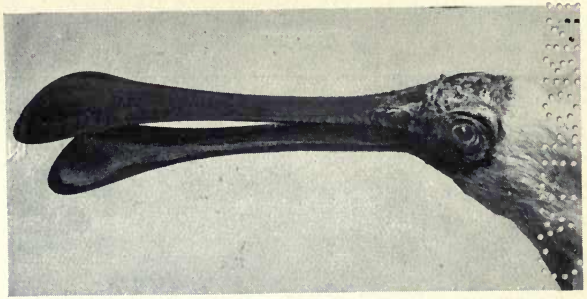
HUIA (MALE).
With bill of ordinary type. Young birds of both sexes have this type of bill.



HERON.
Showing the spear-like type of bill most common among fishing birds.

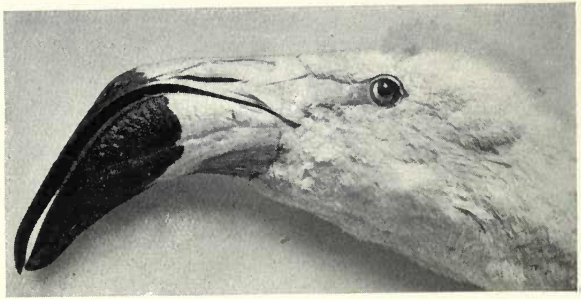


RHINOCEROS HORNBILL.
The "horn" on the bill is hollow, and the bill itself very light.



SPOONBILL.
The Spoonbill feeds by sweeping its bill to and fro in water.

PEREGRINE FALCON.
Showing the strongest development of the hooked and toothed bill of a bird of prey.



FLAMINGO.
The Flamingo is one of the few birds with the upper jaw smaller than the lower.

called "Paradise Duck" in that country; in this the plumage is affected, the drake being a dark grey with a greenish-black head, while the duck is mostly chestnut-red with a snow-white one, and is thus far more striking and conspicuous, though not quite so large as her mate. As in the other case, her daughters confirm the pedigree by resembling their more sombre-tinted father in their first plumage, attaining their feminine plumage later on.

Readers will be reminded of the similar case in human hair, which is short in babies of both sexes, but afterwards tends to grow longer in women than in men, though the general habit of cutting the men's hair makes the difference seem artificial.

The Huia, which in size and shape is not unlike a Jay, was always a bird of limited range, and never found in the South Island; it is now very local, and it is to be hoped that the State restrictions on the capture of the peculiar birds of New Zealand will be successful in preserving it—without something of the sort it would soon have been exterminated "in the cause of science."

Next to the Huia, the bird which shows most sexual difference in the bill is the Capercailzie, so well known to Scottish sportsmen and a common object in our poulterers' shops in the winter; and here there is a possible explanation in a different manner of feeding in the two sexes. The cock has a much larger and more hooked bill than the hen, even in proportion to his far greater size; in fact his bill looks more like that of a bird of

prey than a game-bird. Now, the cock tastes far more of turpentine than the hen, and he is known to feed more on pine and fir-shoots, his mate, with her small ordinary game-bird's beak, seeking her food more upon the ground.

This brings us to the consideration of vegetable-feeding birds; but in the case of these there is seldom much modification of the bill, nearly all the sensational beaks, if we may thus express it, belonging to animal-feeding birds. There is, however, a very peculiar specialized beak in a bird which, like the Capercailzie, is especially a haunter of coniferous woods, and derives its food from them—the Crossbill, in other respects a very ordinary member of the group of Finches. In this bird, often a winter visitor here, and one which has of late years bred quite frequently in Britain, the beak is crossed at the tip, both jaws being curved; the jaws may cross either to the right or the left, and this crossing is quite accidental or indifferent, having nothing to do with sex.

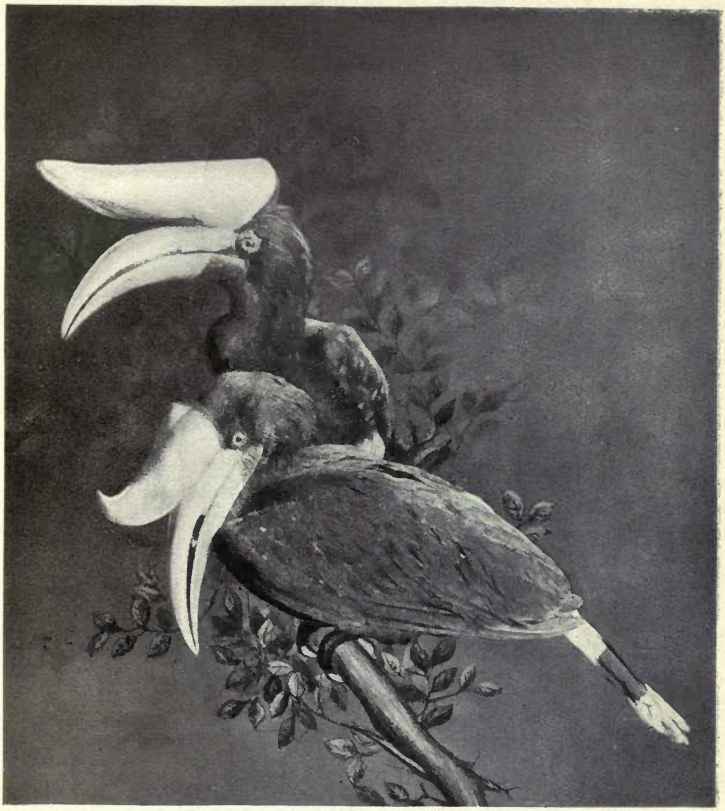
The young Crossbill has, up to the time of leaving the nest, the ordinary Finch-beak shutting evenly; presumably the direction of the crossing depends on the nestling being right- or left-beaked, *i.e.* using its beak instinctively more on one side than another. The particuiar use of the bill is to prise open the scales of pine- and fir-cones, the underlying seeds of which form the Crossbill's favourite food, and are scooped out by the tongue, which is unusually long for a bird of this group.

The most striking beaks found among vegetable-feeding birds are of course those of the Toucans and Hornbills, groups which are constantly confused by people unacquainted with birds, and very naturally, since both are so conspicuously over-beaked, so to speak, that the differences between them are quite over-shadowed by their resemblance in the prominent feature, and their general habits are also much alike, both groups being tree-haunters and fruit-eaters, though they take animal food as well. The Hornbills, however, have three toes in front and one behind, the front ones being more or less connected in a common skin, as in Kingfishers, to which they seem to have some affinity; the Toucans have their toes in pairs, like Woodpeckers, with which they are closely connected by the intermediate family of Barbets (*Capitonidæ*). In fact a very interesting evolutionary exhibit might be made up by any museum possessing plenty of specimens of all three families, so as to show the gradation from the Woodpeckers into the Wrynecks, the Barbets with their Crow-like or in some cases almost Wryneck-like bills, and the very unbroken series of Toucans, ranging from forms like the Toucanets (*Selenidera*), which, in bill and body, hardly exceed the biggest Barbets, of the genus *Megalæma*, to the great black, enormous-billed birds of the genus *Rhamphastos*, the most typical Toucans of all.

In the Hornbills there is no gradation into another family altogether, but there is much difference

between the small Magpie-sized Hornbills of the genus *Tockus*, with little or no "top-story" to the bill, to the large typical Hornbills, often as big as hen Turkeys, with enormous bills generally crowned with a great horny excrescence. The smaller kinds are more insectivorous than the larger, and thus show some approach to the Wood-Hoopoes (*Irrisor*), which have much more curved bills than the ordinary Hoopoes, and feed when on trees, while the common Hoopoes are ground-feeders.

It has been well suggested that the great bills of the larger Hornbills and Toucans are adapted to giving a purchase for wrenching off tough-stalked fruit; as the birds grew bigger, too, they would not be able to venture on such slender branches, and so would need more to reach out for their food. And if the beak had got merely longer without acquiring bulk, any wrenching effort would have been liable to dislocate it. That Hornbills at any rate work their beaks very hard may be inferred from the facts that in the largest and bulkiest-beaked kinds the edges of the jaws are worn and chipped in elderly specimens, and that if the fruit will not come away by fair means, some Hornbills think nothing of throwing themselves bodily off the bough and wrenching it away by sheer weight. No doubt the effort of recovering their perch in gymnastic exercises like this is what gives these particularly awkward-looking birds the deftness on the wing which many people must have observed when watching them catch in the air grapes or other



RHINOCEROS HORNBILLS.

Two forms are shown here, the true *Buceros rhinoceros*, and the straight-horned *Buceros sylvestris*.

TOCO TOUCANS.

The Toco is the largest of the Toucans, and curiously resembles the Rhinoceros Hornbill in the coloration of its plumage and beak.

[*By permission of the artist, Sir Harry Johnston, G.C.M.G.*

food thrown to them in the aviaries in zoological gardens.

Even the biggest and most specialized Hornbills and Toucans like animal food, though the "horn" of the former must often baulk them in obtaining prey from crevices and holes; for I once had a narrow escape from a nasty dig in the face from a Concave-casqued Hornbill (*Dichoceros bicornis*) confined in a hutch in the Calcutta Bird Market; about half the bill passed between the wooden bars, but the broad helmet acted as an efficient "stop" and spoilt the stroke. Buffon was often fanciful in his remarks on animal structure, but I fancy he was right when he referred to the "horns" of the Hornbills as an actual hindrance in food-getting. It would be interesting to know whether the great helmet only developed after the birds had become more definitely fruit-eaters, or whether the inconvenience of possessing it tended to develop their diet in that direction.

There is probably, however, some connection between the adoption of a vegetable diet and large size, for nearly all the biggest birds are either vegetable- or carrion-feeders, *i.e.* eat food which does not require mobility to obtain it, and can be obtained in bulk if at all, so that, if the digestion permits its assimilation, size is favoured and tends to increase.

Reverting to the Woodpecker-Barbet-Toucan alliance, it is interesting to note that the Woodpeckers in spite of their specialization for grub-

hunting under tree-bark, are in many cases fruit-eaters; our own Greater Spotted Woodpecker, for instance, eats several kinds of fruit, and in North America the Red-headed Woodpecker (*Melanerpes erythrocephalus*) used at any rate to have a very bad name as a fruit-eater, even going so far as to go off with an apple spiked on its bill when leaving the orchard, so says Wilson; and one has even specialized in a most peculiar vegetable food, the cambium or inner bark of trees and their sap. This is the Sapsucker (*Sphyrapicus varius*) of North America, which is often quite a pest by its trick of girdling fruit-trees with its rows of punctures made to extract the sap. The worst of it is that its name and bad reputation have got transferred to other small Woodpeckers; just as among us the comparatively harmless Kestrel often has to suffer for the misdeeds of the Sparrow-hawk, which really is an inveterate bird-killer, not confining its ravages by any means to Sparrows, but tackling anything from a Blue-tit to a Woodpigeon, so that in its game-list the chicks of Pheasants and Fowls are quite naturally included.

I have spoken of the specialization of the Woodpecker's bill for grub-hunting, but this is not very striking at first sight, and the degree to which the tip of the bill is formed like a chisel is somewhat variable; it is the hardness of texture that is the important point, and the skill of the bird in using its tool. The Great Black Woodpecker has been seen in captivity to chip two parallel grooves down

an upright post and then prise out the intervening piece, thus going to work in quite a systematic way.

It is of interest to find that in the unspecialized Barbets the power of wood-cutting occurs, though apparently only used for hewing out the nest-hole; but the state of the back of the cage in which a Great Barbet was confined at the Zoo was ample evidence that this bird's powers in this respect are considerable, though the beak is merely Crow-like.

The Crows themselves, however, with their usual versatility, can do a good deal in the way of wood-cutting with their stout bills; Mr. J. Frostick, of Balham, once showed me a Carrion-crow he kept as a pet, and its cage afforded ample evidence of the wood-cutting proclivities of its inmate; and readers of "Barnaby Rudge" will be familiar with the feat of one of Dickens's real Ravens whose biographies are described in the introduction, though the amount of damage done to the "six stairs and a landing," which he "tore up and swallowed in splinters" is of course humorously exaggerated.

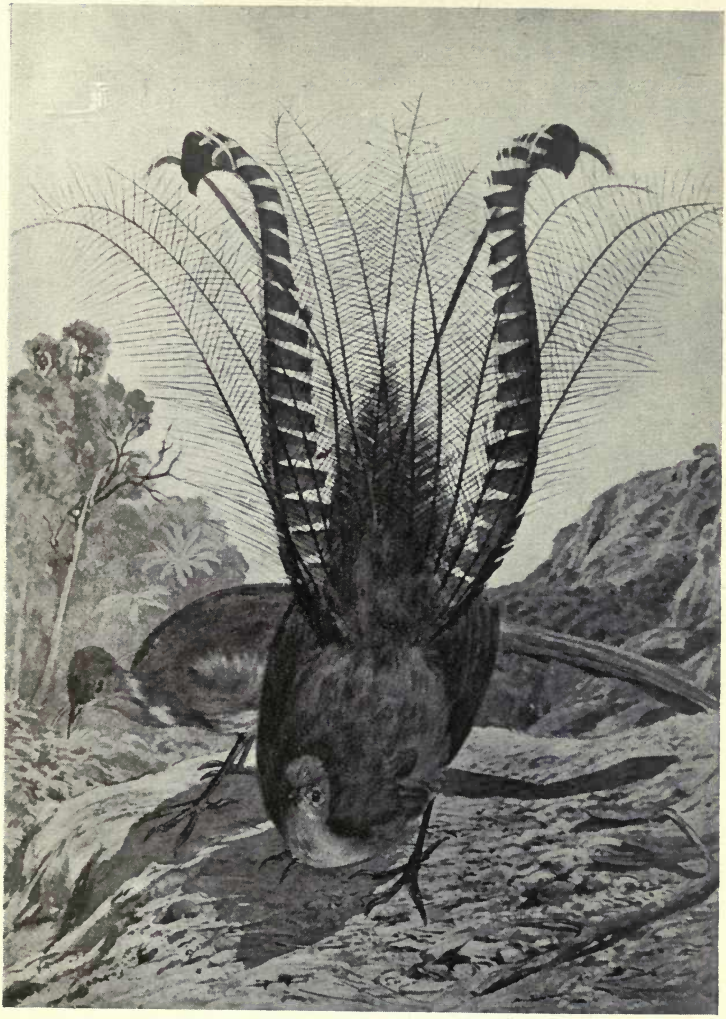
The greatest power of wood-cutting is, however, as every one knows, to be seen in Parrots; it is perhaps for this that their very peculiar bills became so specialized in hardness, shortness, and power, for they mostly build in holes in trees, and are not averse to making holes, either in trees or cliffs, for themselves. Besides, many of them are grub-eaters, and cut away wood in order to obtain their prey, quite taking the place of Woodpeckers in the

Australian region, where these otherwise universally distributed birds are absent.

The chief grub-eaters are the Black Cockatoos (*Calyptorhynchus*) of Australia and the curious New Zealand Parrots known as Kakas (*Nestor*); but the habit is probably commoner than is supposed, since most Parrots in captivity evince a liking for animal food, although too much of this is bad for them, often causing a skin-irritation and the adoption of the feather-plucking habit. This, however, has probably more to do with the want of exercise.

It seems improbable that the Parrots should have developed their extraordinary deep-curved bill, unique among vertebrates in its hinged upper jaw and extreme biting power, merely to feed on seeds and fruit, and it is noteworthy that the Parrot which has the least typical beak, Pesquet's Parrot of New Guinea (*Dasyptilus pesqueti*), in which the upper jaw at any rate is more like an Eagle's than a Parrot's, tears at its food of fruit like a carnivorous bird at flesh, and also has less Parrot-like movements than the rest of its tribe, hopping from bough to bough with a flicking action of the wings—evidently it has not fully attained the Parrot specialization in form or action, and corresponds among the Parrots to the Magpie-Goose among the Ducks.

The White Cockatoos, which are generally ground-feeders, use their bills much in digging up bulbs and the egg-cases of locusts; in the Long-nosed Cockatoos (*Licmetis*), which are especially addicted to a diet of roots, the upper bill is par-



LYRE-BIRDS (MALE AND FEMALE).

The Lyre-bird is the largest of singing-birds, and is one of the few birds which shows decorative plumage without brilliant colours.

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IMPERIAL WOODPECKERS.

This American bird is the largest of the Woodpeckers, and shows the rare peculiarity of the female's crest being longer than the male's.

ticularly prolonged and forms a most effective hoe. Another hoeing genus, in a very different family, is that of the Monauls (*Lophophorus*) among the game-birds, best-known in the person of the splendid "Impeyan Pheasant"; this bird will continue hoeing by the hour, in search of roots and grubs, and scratches very little, although belonging to a group which are particularly characterized by using the feet in this way in search of food.

In fact, the Game-birds used to be known by the general title of *Rasores* or scratchers, and every one knows what execution they can do in this way. Their scratching instinct and capacity, in fact, is no doubt one of their strongest assets in the struggle for existence; the habit is not a common one among birds when applied to food-getting, though it crops up again amongst the Passerines; the Whydah-birds among the Finches, for instance, are scratchers, and so is our Bearded Reedling. The Lyre-bird (*Menura superba*), too, is a most powerful scratcher; indeed, it actually grips clods and throws them back, shifting masses of as much as seven pounds in weight, although not bigger than a Fowl.

The feet, however, are only employed in actually seizing food in the birds of prey—Hawks, Eagles, and Owls—and in these are specialized for the purpose, being armed, as every one knows, with particularly long and sharp claws, and having a most powerful grip, at least in the typical forms. There are some interesting minor specializations among these birds; thus, the especially bird-

killing kinds, such as Sparrow-hawks and Falcons, have very long toes and talons, to give the greatest chance of a grip on an elusive prey seized on the wing. The Falcons usually strike from above, and often kill the prey, when brought down by the talons, with the beak; the Sparrow-hawks chase and clutch, and kill more slowly by their relentless grip.

Reptile-eating Hawks and Eagles have, on the other hand, particularly short toes, adapted to the usually narrow bodies of their prey, and fish-eaters, of which the Osprey is of course the most typical, have the underside of the toes roughened with little spikes, to give them a secure grip of their slippery quarry. It will be noticed that the Sea-Eagles and the great Fishing-Owls of the East (*Scotopelia* in Africa, and *Ketupa* in Asia) have ordinary bare legs, adapted to immersion, whereas ordinary Owls and most of the hunting Eagles are feather-legged. The adaptation here is, however, probably special only in the case of the Owls, for Hawks, which are seldom fishers, are generally bare-legged, as is also the great Harpy-Eagle (*Thrasaëtus harpyia*), which has far the most powerful feet of all the birds of prey, the toes being as thick as a man's thumb, and the claws as big as a bear's.

The strength of these birds is something enormous, and in proportion to their size is greater than that of the quadruped carnivora; the Goshawk, a giant Sparrow-hawk, can if a strong female (this sex

being the larger in birds of prey generally, and especially in this typical Hawk group) actually hold and kill a hare, a creature several times its own weight; and the Indian River-Eagle (*Haliaëtus leucoryphus*), a lighter and less powerful bird than the Golden Eagle, can not only carry off a Greylag Goose, but has been known to strike, lift, and land a fish of a stone in weight, though this quarry taxed its powers to the uttermost, and it could not raise it again when frightened by a shot. In cases like this the impetus of the swoop no doubt counts for a great deal.

As for the Golden Eagle, it can even master the wolf, a beast not only far heavier than itself, but terribly armed to boot with most punishing teeth; it is habitually flown at this quarry by Mongolian magnates, but many birds meet their fate in learning their trade, for after the first grip with one foot is made good, the bird must be quick and dexterous in grappling the beast's face with the other foot to avoid fatal reprisals. The cases in which birds of prey have been found killed by animals of the weasel kind which they had seized are evidently examples of nature's penalty on the bungler, and no doubt exemplify a powerful check on these birds, which otherwise would have few casualties to face except in encounters with each other.

The great Owls are not inferior in relative power and ferocity to the Eagles; a Snowy Owl kept in captivity in Shetland, according to the account of

Saxby, in his book on the birds of that country, once seized upon a cat, and held it in such a powerful grip that had not puss been rescued in time it would have succeeded in its amiable intention of biting her head off.

In contrast to these powerful and ferocious species, we find many birds of prey which feed largely on insects, such as the Hobby and Kestrel among the Falcons, and the little Scops Owls among the nocturnal birds of prey; in both cases the insectivorous forms being closely allied to highly carnivorous ones, for the Hobby is very like a miniature of the arch-bird-killer, the Peregrine, and the Scops Owls are only distinguished by size from the particularly powerful and savage Eagle-Owls of the genus *Bubo*.

Among birds of prey a very near approach to cannibalism occurs in the Barred Owl of North America (*Syrnium nebulosum*), which has an unenviable reputation for devouring its smaller relatives; and the Peregrine Falcon frequently preys on the Kestrel. However, this habit is more widely spread than might perhaps be supposed; the great carrion-eating Petrel known by sailors as the "Nelly" (*Ossifraga gigantea*) remorselessly devours the smaller Petrels, and the Skua Gull or Bonxie feeds on the Kittiwake Gull. Moreover, the Shrikes, some of which are every bit as carnivorous as the Hawks, are only passerine birds, so when they prey on Finches and Thrushes they also are eating near relatives; the Shrike in fact is but a song-

bird modified into a bird of prey, and even yet "mislodging music in a pitiless breast." Unlike the typical true birds of prey, however, it seizes with the bill, not the feet, which differ little from those of ordinary passerine birds.

The foot-grasping habit is so rooted in most of the birds of prey proper that even the insectivorous ones catch their small prey with the feet; it is a common and absurd sight in India when the white-ants or termites are swarming, to see such big birds as Kites (*Milvus govinda*) catching these tiny things in their raptorial talons, with which they can grip and carry off a rat.

There are, however, cases in which the adaptation here is not complete; the Caracara Hawk of America (*Polyborus tharus*), though seizing birds on the wing with the feet—a feat it seldom performs, by the way—picks up ground-prey with its beak, afterwards transferring it to the feet when in flight, as Mr. Hudson informs us. I have seen the Indian Crow (*Corvus splendens*) thus transfer an object from bill to feet, as if he wanted to learn the Kite's trick of foot-carrying; but the object was not food—the Crow is too practical to experiment with anything so valuable, and a bit of stick or dry cow-dung was the subject of the experiment.

Some very curious specializations in the feeding habits of birds of prey deserve mention here; those of the Snail-Hawk (*Rostrhamus sociabilis*) and Bird's-nesting Eagle (*Neopus malayensis*). The Snail-Hawk is a Buzzard-like, brown bird with a

very long hook to the beak and long talons; it feeds chiefly on water-snails of the genus *Ampullaria*, very common in shallow pond-edges in the tropics, but, one would think, very queer food for a Hawk. The long hook of the bill and long talons may be adapted for winkle-pin and shell-grippers respectively, but from what will be said directly it is possible that the adaptation may be only apparent.

The ways of the Bird's-nesting Eagle are still more strange. This species, from South-eastern Asia, has black plumage and a most peculiar foot, with the claws very long except on the outer front toe, which is quite dwarfed. Its habit is to sail over the tree-tops looking for the nests of small birds, which when found it carries off in its long claws, meanwhile ransacking them for the eggs and young, on which it makes its meal in mid-air.

Eating on the wing, by the way, is quite a common accomplishment with birds of prey which capture light quarry; it was quite the usual thing in Calcutta to see a Kite sailing overhead and tearing at something held in its talons. Once one dropped a bullock's eye almost on me, having no doubt found the tough morsel non-negotiable.

Better known than the Snail-Hawk and the Bird's-nester is the Secretary-bird of Africa, which is, indeed, one of the best known of all birds of prey. Most people are familiar with its quaint appearance, as of an Eagle on stilts (I can never see why it should ever have been called the Secretary *Vulture*); the short toes should, however, be

noted, and the method of attacking prey, which the keepers at the Zoo will always display with the aid of a dead rat tied to a string. It will be noted that the bird strikes on the prey to kill it, and does not grasp, using one foot at a time, and so quickly that it gets in two or three blows where a man could only give one; in fact, I am told that the bird will even kill blue-bottles in this way. The wings are kept lifted meanwhile, no doubt in readiness to spring back if the victim retaliates. But in its conflicts with snakes, which have gained it so much notoriety and the protection of our Government in Africa, it is said to bring the wings into action to beat the reptile down. Its prey, however, is not restricted to snakes, but includes any sort of ground animal it can find and kill; in fact, Major J. Stevenson-Hamilton, the Game Warden of the Transvaal, says in his fascinating book "Animal Life in Africa," that it is neither more nor less of a snake-eater than other large birds of prey, so that we cannot regard its peculiar specialization as being an adaptation to a reptilian diet.

In fact, we may easily make mistakes in trying to correlate structure and function, as may be realized in considering the case of the Kea Parrot (*Nestor notabilis*) of New Zealand. Notable, indeed, this bird is, not to say notorious, but not in the way its describer meant when he gave it its scientific name. Every one knows now that it has undergone one of the most remarkable changes of habit ever recorded of any animal. Formerly a feeder on

roots, berries, grubs, etc., it soon after the introduction of sheep into its haunts in the New Zealand Alps became a most cruel and destructive carnivore, with a ghoulish appetite for live mutton, attacking the sheep at the loins and eating deeply into their flesh. It was at first credited with the desire of devouring the kidneys or the fat surrounding them, but this view appears to be a mistake, the locality of attack being merely the part where the unhappy sheep had no chance of dislodging its tormentor. Of course so extraordinary a habit as this fell under the ban of museum scepticism, but it has been proved up to the hilt. Rewards are paid for the killing of these birds, and, unlike all other New Zealand birds except the Weka Rail (which is destructive to eggs and chickens), it may be sent out of the country. It is a curious thing, however, that specimens sent to the London Zoo soon give up the habit of eating meat and feed on the ordinary seed and other vegetable food given to Parrots; one lived there some years chiefly on carrots, thus reverting to its natural diet of roots.

This would seem to indicate that hunger was the first incentive to the change of diet; the insatiable inquisitiveness and destructiveness which are very characteristic of these Parrots would be quite sufficient incentive for them to attack dead sheep and offal, which they did before transferring their attentions, in a natural sequence, to the living animals. They have been known to attack a horse, and the corpse of a man killed by a fall in the

mountains has also been mutilated by them, so that under certain circumstances of helplessness by accident or illness, they might easily become dangerous, just as rats are in similar circumstances.

It is rare, however, for any birds to attack man for food; still, this would seem to be the motive for the attacks made on men in the water by Albatrosses, as in the case where these sea-birds attacked the German sailors in the sea at our defeat of German ships in the sea-fight off the Falklands; and no one with any wide knowledge of birds could doubt that Eagles probably were in former times, when they were more common and fire-arms less so, very serious enemies to children.

It must be remembered that only a very few years ago a case was recorded in the *Field* in which a Golden Eagle attacked an adult in Scotland, though in this case the motive was apparently revenge, as the man, a gamekeeper, had rescued a Grouse from it earlier on the same day. Hasselquist, also, in his "Travels in the Levant," published in the eighteenth century, credits an Owl, which he calls *Strix orientalis*, but which is apparently only the Common Barn-Owl from his description and attribution to it of building-haunting habits, with coming into houses in Syria at night, and destroying babies if not carefully watched.

I may say that on taking a little boy of two years old with his parents to see the Owls at the Zoo some years ago I noticed that all the large Eagle-Owls abandoned their usual apathetic unseeing

stare, and glared down earnestly at the child; and though I could not understand this at the time, on finding Hasselquist's note it struck me that a child-killing Owl might not be at all an impossibility.

To return to the Kea; Smith Woodward has suggested, in Mivart's book on birds, that these Parrots used in the days of the existence of the great Emu-like Moas in New Zealand to attack and vivisect these now extinct birds in the same manner as their descendants now do the introduced sheep; and the possibility of this must of course be borne in mind. The large struthious birds at the present day seem peculiarly helpless against the attacks of smaller birds; in the Calcutta Zoo Crows have lined a nest of feathers pecked from the back of an Emu, and have pecked sores on the backs of Ostriches. This did not happen in my time, but I have seen a Crow sit on the back of an Ostrich and peck it.

If the Kea were thus always more or less carnivorous, its peculiarities would be easily understood; it is, as a matter of fact, in gait and movements much more like a Raven than a Parrot, running freely, and hopping frequently, while it is said often to sail on outspread wings when in flight. Its beak also, very long for a Parrot's and with a comparatively gentle curve of the upper jaw, and its comparatively long legs, with its very dull olive-green plumage, suggest a carnivorous bird rather than a Parrot; but after all, these peculiarities

may simply be due to its being, like the eagle-billed Pesquet's Parrot, an unspecialized early form. Its reversion to a vegetable diet in captivity may point the same way; in any case it is instructive to notice, that, unspecialized as it is, its beak has at any rate a good share of typical Parrot power, judging by its exploits in the way of gnawing wood. I have also seen, when a couple were kept in a cage in the indoor parrot-house at the Zoo, one cracking canary-seed, while the other amused itself by levering up the perch in the next cage hard alongside, for the discomfiture of the inmates.

The Kea's is not only the most notorious, but really the most remarkable change of diet known; but minor changes are often recorded, and though these are often brought about by man's interference in producing a new food-supply or in transporting birds from one country to another, they must not be despised as unworthy of study on that account, since in undisturbed Nature the equilibrium we hear so much about is not constant. Birds colonize areas on their own initiative occasionally, and plants even invade new habitats as circumstances become more favourable for them, so that there are always opportunities for changes of diet.

Mr. Hudson has recorded how, since the giant grasses of the Argentine pampas have given place to the turf-making grasses and clovers of Europe, the Chaja or Crested Screamer (*Chauna chavaria*), which used to feed on water-plants, has taken to grazing on land; it is a curious thing that the

fowl-like beak of this bird looks much more suitable for such a diet than for aquatic herbage, for which the broad bills of Swans and Ducks are better fitted; and in fact the most purely terrestrial Geese show a great reduction in the size of the beak compared with the rest of the family. So that, as in the case of the Kea, the new habit seems quite in conformity with the structure.

It has been noted in New Zealand, also, that the native Pigeon (*Carpophaga novæ-zealandiæ*), naturally purely a tree-bird and a feeder on berries and buds, has been found feeding on the ground in rape-fields; and a similar change has very probably taken place in the habits of our Wood-Pigeon, which in the primitive state of Europe was probably much more exclusively a feeder on tree-produce than it is to-day, when the grain and root-crops, and the clover of the meadows, tempt it to feed a great deal on the ground; here it can be seen to be not quite in its element, for it is far less quick in walking than the common Pigeon, a true ground-feeder, and seems not to be able to run, always taking wing when pressed.

The Wood-Pigeon, as can be easily observed in our London parks, is a good example of the extraordinary gluttony of some birds; there is some excuse for its greedy feeding when its food consists of herbs, buds, etc., but it keeps up the custom on receiving the public dole of bread and monkey-nuts, which latter it swallows with the husk enclosing them. One evening I began to toss a few of these

nuts to a Pigeon I encountered just to see how many it would take; but after eating a couple, it only took the next two or three in its bill and pettishly threw them aside, after which it flew off. Evidently it was already full-fed, but could not resist the temptation to swallow a little more, and its discomfiture reminded me of the story of the glutton Quin, who, after eating all he could of the homely joint of boiled aitchbone of beef, actually burst into tears, after toying with a slice from a roast haunch of venison, which his host, knowing his weakness, had kept in reserve till he should be *hors de combat.*

I have also heard of a case in which some Turkeys kept on one of the Channel Islands obtained access to a garden in which there were mulberry trees, and gorged themselves till they died from the effects of their meal. Birds will even get drunk, or something very like it; the Jungle-Fowl of Southern India (*Gallus sonnerati*) and of Ceylon (*G. lafayetti*) feed freely on the fruit of plants of the genus *Strobilanthes*, which so stupefies them that they can be knocked over with a stick; and in South Africa Bulbuls (*Pycnonotus tricolor*) feed on the fermented berries of the Cape gooseberry, which so intoxicate them that they cannot fly straight or far.

Many years ago, when a boy at Maidstone, I had an opportunity of seeing that a bird may appear to enjoy the feeling of intoxication. Having read that small birds could be caught by offering them turnip-seed soaked in whiskey, I tried the

experiment, it being winter-time with snow on the ground. Only one bird responded to the alcoholic invitation, a cock Chaffinch, which after partaking was visibly overcome, but able to escape capture; and I retired myself with a feeling of some compunction, fearing he might fall a victim to some cat in his irresponsible condition. But I might have spared my pity; for next morning, a cock Chaffinch, with ruffled plumage and in an aggressive mood, was finishing the medicated seed and keeping off the Sparrows, who were now quite ready to experiment themselves.

After this, I can believe a story which was told me in India by a bird-dealer, to the effect that if you gave a bird an opium pill and then released it, it would come again next day for a repetition of the dose.

Of course the Vulture and the Cormorant are regarded as the stock examples of gastronomical excess in birds; but I doubt if this is just. They certainly can perform phenomenal gorging feats, but it must be remembered that the Cormorant must at any rate search and work hard for its food, and that the Vulture's meals are very intermittent. From what I saw in India, where Vultures were practically always on view aloft at some time of the day and somewhere, while one could seldom see them feeding, I came to the conclusion that they probably only got a meal about once a week, so that if they indulged heavily at such times they could not fairly be accused of gluttony. It will be

noticed that in confinement, where Vultures are fed regularly, they do not by any means eat immoderately; a piece of meat the size of a good big steak will suffice for the daily meal of a bird as big as a Turkey.

Mr. Beebe, the Bird Curator of the New York Zoo, found that Vultures in captivity preferred fresh to tainted meat, and an attempt made some years ago to feed the Vultures on entrails instead of flesh at our London establishment did not meet with success, so that it is pretty obvious that these birds in a state of nature are often forced by hunger to consume substances which they do not really appreciate. The extreme case of this is that of the small White Scavenger Vultures (*Neophron*) which habitually feed on excrement, not being strong enough to contend with the larger Vultures for carrion; Tristram in Palestine saw them looking on wistfully while Griffon Vultures tore at a carcase, to which they eagerly rushed as soon as the big birds retired at his approach, only to be driven off when their tyrants deemed it safe to come back again.

It is well known, too, that hawthorn-berries form an important part of the food of our familiar birds of the Thrush tribe, and of Wood-Pigeons; yet during several London winters, which have been mild, I have noticed that haws hung on the trees till spring, untouched by the numerous Blackbirds, Thrushes, and Wood-Pigeons that frequent Regent's Park, showing that these berries are

really emergency rations, which are seldom touched so long as more palatable food is obtainable. Holly-berries are known to be even less favoured, while on the other hand the berries of the mountain-ash are soon eaten up, and Mr. Hudson has described Missel-Thrushes coming to yew-trees on the downs again and again, disgorging these berries half-digested in order to return to the feast, a piece of depravity only to be compared to the practices of the gluttons of ancient Rome, who were wont to go out to be sick in the middle of dinner.

Most observant people have seen, too, how the Starlings strip the elders of their berries as soon as these are ripe, and in India I found their relatives, the various Mynahs, equally attentive to the berries of the peepul fig (*Ficus religiosa*), which were also attractive to the Barbets; the Bulbuls especially revelled in the berries of the introduced *Lantana* shrub, though in winter I have seen them eating buds, though with no goodwill, the buds being evidently only taken in default of better food.

The tree most attractive to birds I have ever seen, however, is the whitebeam (*Pyrus aria*), at any rate in the case of a specimen which used to stand close to the South Gate of the Zoological Gardens before the new Eagle Aviary was built. When this was hung with its large orange haw-like berries, it was constantly frequented by Starlings (which certainly do not eat ordinary haws if they can help it), Blackbirds, and Wood-Pigeons, all intent on feeding on the fruit as long as it lasted;

I once even saw a Moorhen in the top of the tree, and although I did not actually see it feeding, unless it was there after the fruit I do not know what its business was, there being a much more natural haunt for it in the rushes and shrubbery of the Three-island Pond a few yards away.

The traditional diet of worms is probably not so entirely to the taste of birds as one would suppose; at any rate, on keeping a wild-caught Missel-Thrush in a cage I noticed that it would not come down from its perch for an earth-worm unless I stood well away, while a mealworm (an indoor-living beetle-grub which it could hardly come across naturally) would bring it to the floor at once.

A Song-Thrush also I knew in India and supplied with gentles would not eat the local earthworms. I may say these had a very peculiar faint, sickly smell; but on the other hand I certainly rarely saw wild birds eating these—the only instances I can remember of seeing a bird with a worm in its possession being those of a Brown Shrike (*Lanius cristatus*)—a bird very like the hen of our Red-backed Shrike; the White-breasted Kingfisher (*Halcyon smyrnensis*), which is more a hunter than a fisher; and the common Babbling-Thrush (*Crateropus canorus*), which I have often seen, on the other hand, pecking away at the earth-galleries of the termites.

When these "white-ants" swarm, they furnish a free supper for a great variety of insectivorous birds, notably the Crow (*Corvus splendens*), Kite

(*Milvus govinda*), King-Crow (*Dicrurus ater*), and Roller (*Coracias indica*). Similarly one can see the swarming of the true ants greatly appreciated by our Sparrows and Starlings, the latter especially capturing them with almost Swallow-like skill; while on the other hand I have seen a Swallow reverse its natural habits by settling to pick these ants up off the ground.

The most extraordinary aberration of feeding-habit I ever witnessed, however, was the behaviour of a Song-Thrush I watched at Oxford some years ago, as it was running along the edge of the stream that flows through Magdalen College grounds; suddenly it dashed into the water and secured one of a shoal of minnows, which it beat on the ground and then swallowed whole. It is probable that fish are often eaten by land-birds when the opportunity presents itself, as they certainly are by water-birds not usually reckoned as fishers; thus, I have seen a Coot I kept in India suddenly duck its head under and secure a little fish—and it must be remembered that to an insectivorous bird anything will serve for an insect if it is small enough.

In India I have seen the House-Mynah (*Acridotheres tristis*) with a gecko lizard in its bill, and in Africa the exquisite Malachite Sun-bird (*Nectarinia famosa*), a nectar-eater by custom and structure, has been found to have fed on tiny lizards; while in Britain the Missel-Thrush has not only been found preying on the young of the

Hedge-Sparrow, but even carrying off a young Song-Thrush—a feat nearer actual cannibalism than any of those recorded above of birds usually reckoned as predatory.

Predatory birds of all families, by the way, generally agree in their liking for mice; and these "smelly" little rodents are likewise much appreciated by omnivorous feeders. Fowls and Ducks will swallow them, and in experiments on the feeding of the common Crow of America (*Corvus americanus*), in captivity the experimenters found that it appeared to be impossible for a Crow to be so full that he would refuse a mouse, and that timid new-caught specimens would crowd to the front of the cage to seize one. And we all know the service that Gulls and Rooks, as well as Owls and Hawks, did in the vole plague in Scotland a few years ago.

American investigators have also found that Crows especially affect, as investigation of stomach-contents shows, strong-smelling beetles, so that it is not safe to put down an insect as unpalatable simply because it smells nasty to us. In India I have found the great and very foul-odoured cockroach (*Periplaneta americana*), an exotic and usually an indoor insect, was readily accepted not only by the Racket-tailed Drongo (*Dissemurus paradiseus*) and Babbling-Thrush in captivity, but also by the Brown Shrike outside, while I saw Kites and Sparrows also feed on casual specimens they had obtained.

It is perhaps rather significant, however, that

just as birds particularly readily eat termites, which are used as human food in Africa, so they are also particularly fond of grasshoppers and locusts, which are and have been more widely used as human food than any other insects, being even permitted to the Jews by the Mosaic law. Jerdon, whose observations on Indian birds have never been superseded, though often amplified, considered that grasshoppers were the staple food of insectivorous birds in India, and the observations of American investigators have shown that they are equally appreciated by the birds of North America.

When locust-swarms invade a country, they are preyed on wholesale by a great variety of birds; in the case of the only swarm—a very scattered one—I ever saw in India, it was amusing to see the Calcutta Sparrows, who probably had in few cases ever seen a locust before, valiantly tackle these huge shrimp-pink grasshoppers on the wing and bring them to the ground.

Certain special kinds of birds also have long been known as the particular enemies of locusts, following them everywhere, and thus earning the gratitude of humanity; of these the most noteworthy being the Rosy Pastor (*Pastor roseus*), the most beautiful of the Starlings, in Eastern Europe and in Asia, and the Pratincoles or Swallow-Plovers (*Glareola*) in Africa, where also another Starling (*Dilophus carunculatus*) is a well-known "Locust-bird."

Dragon-flies are also greatly appreciated by birds; I have seen two very different species using them

to feed their young in our Museum grounds in Calcutta—the Red-eared Bulbul (*Otocompsa emeria*) a fruit-eating tree-bird, and the Indian Dabchick (*Podicipes capensis*). The victims of the Bulbuls were always, so far as I saw, the slender small Agrionid types; so were the Dabchicks' generally, and it was amusing to see the little divers sneak along with head lowered to the surface, and capture the resting insect with a sudden spring. I once saw a bright scarlet Libellulid offered to a young Dabchick, and once saw a Brown Shrike capture one of these red dragon-flies in repose. It is at such times, I fancy, that these most active of insects probably fall victims, and the same remark would apply to flies. Quick as these are on the wing, I have seen the heavy, awkward-looking Muscovy Drake (*Cairina moschata*) waddle up and pick them off leaves with ease and certainty.

To birds which are specialized for catching insects flying, such as Swifts, Swallows, etc., of course no flying insects present any difficulty, but it is significant that birds of this type, whose preying habits are so well known and conspicuous, rarely seem to attack butterflies. No bird is known as the "butterfly-catcher" anywhere, though we have "bee-eaters" and "fly-catchers," and though moths are ravenously pursued, as one may see even in London with the Sparrow. This is not to say that birds never eat butterflies, but that these do not form a common prey; in India I certainly did not see a bird attack or possess one oftener than

once a year on the average, though particularly on the look-out for this, and the American investigations on the food of birds showed that in 40,000 stomachs of insectivorous birds four butterflies only were found.

CHAPTER IV

Nutrition (*continued*)—Manipulation of food—Powers of digestion, differing in different groups—The formation of pellets or castings—Difference in the food of old and young in some cases—Different methods of feeding the young—Young assisting parents in feeding their juniors—Feeding of each other by the sexes—Drinking, and eating of such substances as salt and earth.

GENERALLY speaking, there is little manipulation of food among birds, it being generally swallowed whole; and in many cases the power of deglutition displayed is almost as remarkable as in the case of reptiles. Fish-eating birds have the greatest reputation for bolting huge morsels, but some of the vegetable-feeding groups are very good seconds, especially the large fruit-eating Pigeons, some of which are instrumental in disseminating the nutmeg by swallowing it for the sake of the investing "mace."

In accordance with this habit of wholesale swallowing, the tongue is of little importance in most birds; and although it is generally well-developed, it is very rarely protruded beyond the bill, and generally lies nearly inert within the lower jaw. In the Pelicans and their allies, Gannets, Cormorants,

and Snake-birds (*Plotus*), it is a mere pimple-like rudiment, as it is also in the curious Shoe-billed Stork (*Balæniceps rex*); it is tempting in this case to put its disappearance down to the necessity for clearing the course for swallowing large prey, but it is very doubtful if this explanation is correct, for a very short tongue, if not an actually rudimentary one, occurs in groups with different feeding-habits, while both long and short tongues are found in groups where the food is the same.

Thus, the animal-feeding Kingfishers and the mainly fruit-eating Hornbills both have very short tongues; the Herons have long tongues, the Storks short ones—both animal-feeders. Among vegetable-feeders, the Toucans, though so like the Hornbills in their form and habits, especially with regard to the bill and its use, have long tongues; the Partridges have tongues of suitable length for their beaks, the Tinamous, so like them in feeding and general habits, very short ones, like their giant relatives of the flightless Ostrich tribe, all of which are short-tongued, including the small worm-eating Apteryx.

It would seem, therefore, that in most cases the possession of a tongue proportionate to the bill or a very short one is a group-character, and that the organ is in a state of degeneration in many cases. I may mention, however, that in two cases I have seen birds indulge in the curious—for them—action of licking their chops; in that of the Heron (*Ardea cinerea*) and the Pied Kingfisher (*Ceryle varia*), both

fishers, but one long-tongued and the other short, though the beaks are so much alike.

In some cases, however, the tongue may be useful and even of vital importance; we have seen it is so in the Crossbill, and in the Woodpeckers in the various honey-feeding groups it is most instrumental in getting the food. Woodpeckers have the tongue very long and wormlike, and can protrude it to a distance at least equal to the length of the bill; the tip is horny and barbed along the sides, so that the organ not only acts as a probe but a grapple, and is used to drag out grubs, etc., that cannot be reached with the bill.

In the Sapsucker above-mentioned the armature of the tip is slightly modified, so that it is more like a brush than a spear-head. I found in young specimens of the Indian Golden-backed Woodpecker (*Brachypterus aurantius*), which I reared from the nest, that the end of the tongue is plain until the bird is fledged, the barbs not appearing till later; one very tame one I had gave tactile demonstrations of the use of the tongue as a probe, for she used not only to sound the top of my head with her bill in a most uncomplimentary way, but tickle my ears as if they were so many worm-holes.

In our Wryneck the protrusibility of the tongue and its use in feeding on ants and their cocoons has long attracted notice; the quickness of action in this case is such that the ants' cocoon appears to the observer to be attracted as by a magnet; in the bigger and slower-moving Woodpecker the

worm-like tongue is conspicuous enough. No doubt the apparent attraction of the Wryneck's food to its bill, and the bird's queer snake-like movements under excitement, were what commended it to ancient sorcery as a love-charm; it was, as students of the classics know, bound to a wheel, which was spun as a love-charm, the "iynx" being invoked to bring the beloved person to the spinner. The custom, indeed, became proverbial; "to spin the Wryneck" at any one was the Greek equivalent for our "setting one's cap" at him.

To turn from Wrynecks and witches to Woodpeckers; the extensile tongue is brought into play by others than the Sapsucker to procure vegetable juices; a Woodpecker in Jamaica (*Melanerpes striolatus*) makes itself very objectionable to planters by puncturing the rind of the sugar-cane and sucking out the juice; and another in Cuba (*M. superciliaris*) is such a pest by performing a similar feat in the orange-groves that it is, or used to be, the custom to turn the army on to Woodpecker-shooting when there was not a revolution on hand to keep them healthily occupied. One of this species was some time ago in the possession of Mr. J. D. Hamlyn, the well-known bird-dealer, and used to amuse itself by using its tongue to grapple the tails of some Budgerigars or Grass-Parrakeets in the compartment immediately above it.

These sap- and juice-sucking Woodpeckers naturally remind one of the true nectar-feeding birds,

of which the Humming-birds of America are far the best known; and it is a curious and interesting fact that the Humming-birds and Woodpeckers both have the tongue supported on C-springs, for in both the horns of the "hyoid" bone, which supports the base of the tongue, are immensely long and slender, and curve right over the back of the head. This is, however, only one of the cases in which a common internal character is no more important than a common external one, for there is no reason to suppose from the rest of their structure that the Humming-birds and Woodpeckers are related; and the tongue itself is quite different in the Humming-birds, for though just as protrusible as the Woodpecker's tongue, it is composed of two horny tubes lying parallel, each side of the tongue curling inward, and the whole forming a suction-pump most efficacious in sucking up honey from flowers.

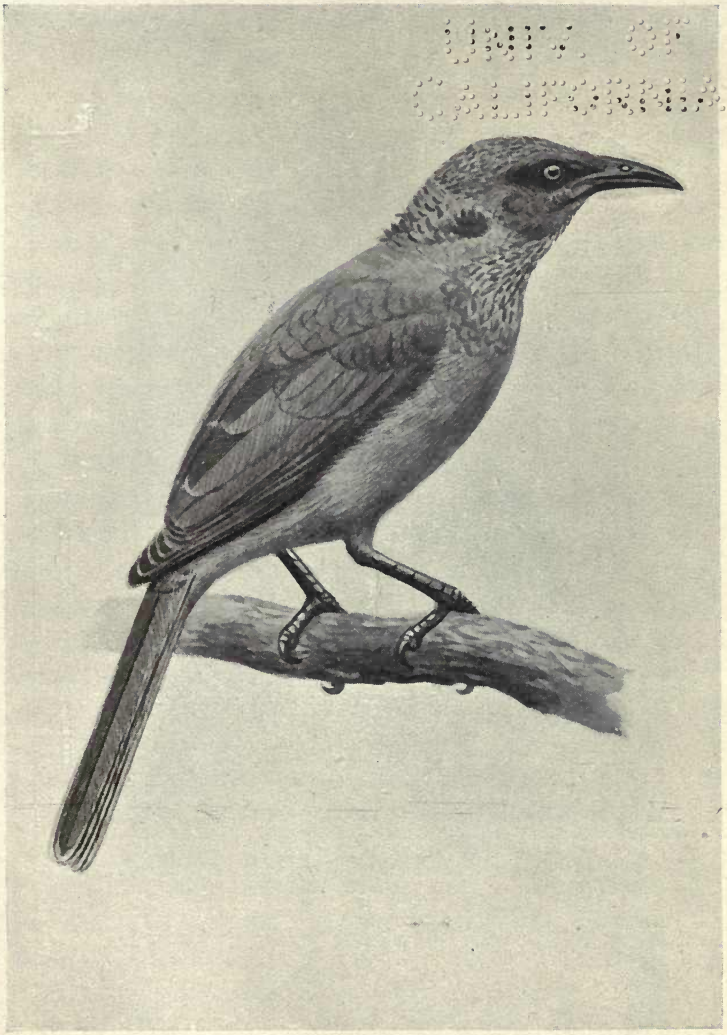
Syrup-sucking is only a side-line with the Woodpeckers, but with Humming-birds it is certainly the main business in many cases, though all eat insects more or less, and some, such as the plain-coloured "Hermit" group (*Phaëthornis* and allies) do not visit flowers at all, but feed only on insects, for which they search the trunks of trees and the undersides of leaves, always hovering, however, just as the flower-feeding species do before the flowers.

That Humming-birds are essentially syrup-drinkers is shown by the fact that they come readily to glasses of artificial syrup put out for them, and

when newly captured will readily drink up syrup while held in the hand. So will the Sun-birds of the Old World—at any rate the two Asiatic species of which I have had experience, the Purple (*Cinnyris asiatica*) and the Amethyst-rumped (*C. zeylonica*).

These small and brilliantly coloured birds are often mistaken for Humming-birds, just as the Hornbills of the East are often called Toucans, the American birds in each case having obtained the earlier and greater reputation with the public at large, as well as with naturalists. And indeed the habits of the Toucans and Hornbills are sufficiently alike to afford a good excuse for this ; but the Sun-birds, charming little creatures though they are, seem commonplace after the fairy-like hovering Humming-birds, since they simply hop about like Tits or small Warblers, and do not hover more than those birds do. Their tongue is also less specialized, though also tubular, but their diet is exactly the same, and Mr. A. Ezra, who had at the time of writing the only two living Humming-birds in this country—one specimen each of the Garnet-throated (*Eulampis jugularis*) and of Ricord's (*Sporadinus ricordi*)—finds that they thrive well on the same fortified syrup, composed of honey, Mellin's baby-food, and condensed milk, which has well served the various species of Sun-birds for which he first used it.

Neither Sun-birds nor Humming-birds can support existence for long on a diet of sugar-syrup alone,



BOURU FRIAR-BIRD.

The head in this large Honey-eater is feathered, but the more typical Friar-birds are bald-headed, whence the name given them.

BOURU ORIOLE, SHOWING RESEMBLANCE TO FRIAR-BIRD.

It will be noticed that this dull-coloured Oriole has much shorter wings than the brilliant Golden Orioles further west.

though they will live on it at times for weeks; Mr. Hamlyn brought a specimen of the Malachite Sun-bird (*Nectarinia famosa*) all the way from South Africa on plain syrup only, and another London dealer, Mr. De Von, brought a Humming-bird—and a young one at that—over from the West Indies on the same simple diet. It is true that neither survived long, but these small birds must find more nutriment in sugar than it is generally credited with affording.

Besides the Sun-birds, which are typical Passerines, another passerine group are well-known nectar-feeders; these are the Honey-eaters of Australasia, which are the common "small birds" of that region; they are birds of quite ordinary appearance, for though some are very small and bright-hued, with long curved beaks, like Sun-birds, most are plain in tint, and in size equal Finches or even Thrushes and Jays, while their beaks are not very strongly curved. They have, however, a tubular tongue with a brush-tip, and feed mostly on honey when they can get it, though taking plenty of insects as well. All these honey-eating insectivores, by the way, capture insects with the beak, just as Woodpeckers often do.

Other passerine birds scattered here and there in different groups are very fond of sweet juice, and have extensile if not very modified tongues for obtaining it; such are the lovely leaf-green Bulbuls of the genus *Chloropsis* in the East, the active *Sibias* among the Babblers, and the American

Sugar-birds (*Cœreba*) and their allies, which are supposed to be related to the fruit-eating Finch-like Tanagers, and certainly grade into them if a whole series is examined, though the typical long-billed *Cœrebas* are so like Sun-birds that if they had been Oriental birds they certainly would have been classed with them. The most charming of all, the Yellow-winged Sugar-bird (*Coereba cyanea*) has often been exhibited at our large bird-shows.

It is not surprising that the honey-sucking habit should have originated independently in several groups, for it occurs now and then in quite ordinary birds as an occasional trait. Gilbert White has described how the Lesser Whitethroat runs up the stem of the crown-imperial lily to sip the honey from the flowers; and in India the Pied Mynah (*Sturnopastor contra*), although the most insectivorous of the Mynahs in the ordinary way, attends without fail at the blossoming of the magnificent red-flowering cotton-tree.

It is not without interest in this connection to note that our Starling, introduced into New Zealand, has learnt the habit of drinking honey, in this case from the flowers of the New Zealand flax (*Phormium tenax*). As this plant is grown in some parts of England, it would be of interest to know if our Starlings here have learnt this habit; if not, it would seem probable that in New Zealand the introduced birds have picked it up from a native honey-eater, the Tui or Parson-bird (*Prosthematodera novæ-zealandiæ*), which curiously resembles

them in plumage, being dark dull brown when young, and richly glossed with green and bronze when adult.

Besides the family of Humming-birds and the various honey-sucking groups of Passerines above alluded to, there are honey-sucking Parrots, and in the case of these, too, the honey-sucking habit has evidently originated more than once quite independently. These birds have longer and more protrusible tongues than other Parrots—though the difference is not great—but they differ in detail.

In the Lories, which are far the most numerous and best-known of these Parrots, the tongue has the papillæ on its end much elongated, so as to form a very short-fibred brush; in the Nestors, of which only the Kaka or Forest-Parrot of New Zealand (*Nestor meridionalis*) and the sheep-worrying Kea survive, the end of the tongue is plain, but has under it a plate of horn not unlike the human nail, of which the end is split into bristles; while in the little Bat-Parrots (*Loriculus*), which are so peculiar in their habit of sleeping upside-down, the tongue is quite ordinary, although they are confirmed honey-eaters.

It seems curious to find honey-eaters among such a group as the Parrots, with beaks so strongly specialized for cracking and crunching; and as a matter of fact some at all events of the syrup-sipping forms will eat seed in confinement, cracking it in quite the normal way, although too much of such food is said to give them fits.

The power of cracking the harder seeds is very highly developed in the typical Parrots; as may usually be seen at the Zoo, the great Hyacinthine Macaw (*Anodorhynchus hyacinthinus*) can crack a Brazil nut with no more effort than a Canary bestows on a grain of hemp-seed. This cracking and rejection of the husks of seed, etc., is particularly characteristic of Parrots, and of Finches among the Passerines, and in doing this the tongue undoubtedly comes into play to some extent, as may also be seen when a Parrot chews up a piece of food, as the larger species at any rate do, these showing the nearest approach to mastication that is found among birds.

The seed-cracking habit, however, occurs also in the thicker-billed Larks; the Larks, by the way, are a group particularly well exhibiting the gradation of beaks—our Skylark has an ordinary bill suitable for any purpose, picking up seed, shoots, or insects. From this a gradation can be traced to the long thin almost Hoopoe-like bill of the great Desert Lark (*Certhilauda alaudipes*), only suited for digging and probing for insects; and on the other side to the great heavy seed-cracking bill of Clot-Bey's Lark (*Rhamphocorys clot-bey*), which equals in size and strength that of most of the "Grosbeaks" among the Finches. And as Larks are only passerine birds, and very much alike except for their beaks, the evolution here would seem to be comparatively recent.

Like the honey-sucking habit, the seed-cracking

habit crops up here and there; I have seen at the Zoo the small Red-billed African Hornbill (*Lophoceros erythrorhynchus*) cracking canary-seed with its great clumsy bill, though it was not very successful in rejecting the husk, and swallowed some of this as well as the grain. It is interesting, too, to offer monkey-nuts to Sea-gulls and Curassows, and see how they deal with this unknown food by crunching the brittle shell and then dropping it on the ground to pick up the disclosed nuts; it evidently only needs a little more skill to make them efficient seed-shellers.

Some birds, without strength of bill to crack seed, get over the difficulty by holding it down with their feet, and splitting it with the bill; this is particularly characteristic of the Tits, and thus, I find, a Hooded Crow manipulates a monkey-nut.

It is, of course, quite the usual custom of Tits and Crows to use their feet in holding any article of food which they need to divide, and in accordance with the general practice of birds which thus behave, they do not swallow their food in huge mouthfuls, but rather the reverse. Crows, indeed, may often be seen to gulp, apparently, large lumps; but these are in reality only pouched beneath the tongue, to be afterwards disgorged and torn up.

The habit of using the foot or feet when feeding is a comparatively uncommon one, and generally restricted to perching birds; it is very familiar and most perfectly developed among the Parrots, which hold up their food to their mouth in quite a

human way, though it will be noticed that as the foot cannot be turned inwards, as it is by fruit-bats when behaving rather similarly, it is the knuckles or dorsal surface of the foot that is presented to the mouth. The habit, however, of "fisting it" when feeding is not universal among Parrots, being not practised by the little Love-birds (*Agapornis*), the Budgerigar (*Melopsittacus*), and no doubt many others. The Kea when holding food in the foot does not raise this, but rests it on the hock, so that it has to stoop to its food, thus showing the habit less perfectly developed, as one would expect from its less specialized structure.

It is in this way, too, that those passerine birds, other than Crows and Tits, which use their feet in feeding hold their food; such are the Shrikes and the Babblers, though the habit is not universal here either, albeit very characteristic of the more typical genera. Finches have very generally the habit of holding down food on to the perch with one foot, as any one may see on presenting the family Canary with a piece of salad, but, as I remarked in the first chapter, Sparrows do not do this, and no doubt other Finches are equally inept; but the point has probably never been worked out.

Woodpeckers and Barbets seem not to use their feet in feeding, though the former will wedge an object into a crack to hammer it, like the passerine Nuthatch; but Toucans in some cases hold food

down with one foot. Cuckoos rarely do so, but I have noted the habit in the Indian "Crow-Pheasant" (*Centropus sinensis*) and the South American Guira or White Ani (*Guira guira*), both of them birds which are more like Magpies than Cuckoos in form and general habits, so that it is interesting to find them reproducing a Magpie gesture also. The curious little fruit-eating Colies or Mousebirds of Africa also grapple food with one foot.

Among birds of prey the habit of using the foot for prehension of food is apparently universal, as one would expect from the habit of actually capturing the food in this way. The food is usually so held down, but small objects may be grasped and held up to the mouth as by a Parrot, especially by Owls, which differ from Hawks and most birds which handle their food with their feet (to use a rather Hibernian expression) by bolting huge pieces and even whole small animals such as mice, their swallowing capacity being very great. Even the Vultures, which do not usually seize live food, and the long-legged running Secretary-bird, use their feet in feeding, and the Cariama, which is so like the Secretary in many ways, though really nearer the Cranes and Rails, employs its foot in the same way. So does the Weka (*Ocydromus*) among the true Rails, and the Blue Moorhens (*Porphyrio*) hold up their food in one foot just like Parrots, a fact which was known to Pliny, who specially mentions it.

Except for these, however, the habit is hardly

known among ground- and water-birds; no swimmer practises it, except the Skua Gull, and the common Fowl only in a casual and half-hearted way may put a foot on a piece of cabbage-leaf it is picking at. The Brush-Turkey (*Catheturus lathami*), however, a less specialized bird, fairly grips its greenstuff; the habit seems commoner among Australian birds than elsewhere, for I noticed even one of the Honey-eaters, a Miner (*Myzantha*), hold a grape in this way, and a Fantail Flycatcher (*Rhipidura tricolor*) playfully grasping dead leaves, when these birds were on view at the Zoo.

The details given above will seem to most ornithologists hopelessly trivial, but the habit of using the foot or otherwise is a most important one to a bird; those not possessing it are always liable to starve or choke, the latter calamity being a very common one among fish-eating birds, whose supplies are intermittent, while except in the case of fishing birds of prey they have little notion of dividing their quarry should it prove to be unmanageable. They do what they can by vigorously beating it on their perch in some cases, as in the case of the Kingfishers, and this habit of perch-whacking is also seen among the Bee-eaters and many other birds which do not supplement the bill with the foot.

Similar is the custom of the Thrush in beating his snails against a stone; I have seen it do the same thing with a looped-up lob-worm, against the bottom bar of an iron railing, no doubt in order to

prepare it for the tender stomachs of the young—a necessary preparation, for only while writing this book I was told of a case of a young captive Thrush being killed by being fed with worms by its human rearer, the annelids having fairly forced their way through the tender tissues out of the young bird's body.

This I can quite believe, as, though I have not witnessed such a misfortune myself, I have had birds of mine, which had eaten too many maggots, pass them not only undigested, but alive, and this not only in the case of a very tiny species, the Crimson-backed Flower-pecker (*Dicæum cruentatum*), but even such a large one as the Gold-backed Woodpecker (*Brachypternus aurantius*); with soft vegetable food, too, I have seen the Crimson-breasted Barbet or "Coppersmith" (*Xantholæma hæmatocephala*) pass sultana raisins entire. This, however, and also the Flower-pecker, are fruit-eaters especially; and such birds seem to have the weakest digestions of any, and correspondingly the greatest appetites; they are always gorging, and pass the food out in an almost unaltered condition, so that the structure of food swallowed is plainly perceptible. The same thing is noticeable with the fruit-eating bats.

So sketchy, if I may use the expression, is the digestion of the little Tanagers of the genus *Euphonia* (one of which, the Violet Tanager (*E. violacea*), is not infrequently imported), the most typical fruit-eaters of a group which gradually grades into the

seed-eating Finches, that they have practically no stomach, the dilatation of the digestive canal where this ought to be being so slight as easily to escape notice, so as to give the food a straight run through.

As an opposite example of a small passerine bird with remarkable powers of digestion I may cite the Hedge-Sparrow, which, though not a Sparrow nor any sort of Finch, being an insectivorous bird by structure and relationships, has a curious fondness for seed, preferring it, when caged, to soft food, and swallows it whole, digesting even hempseed husk and all; moreover, with such an able digestion it has a vigorous appetite, eating continually and voiding a corresponding amount. It will be noticed that, although seldom seen to pick up a morsel of perceptible size, this little bird is almost continually employed in eating when observed at liberty.

The most perfectly organized digestive organs are found in the Pigeons, in which the crop, an enlargement of the gullet where the food is stored and macerated, is particularly large, and double, whereas in many birds it hardly exists, or is merely a temporary dilatation; in passerine birds which possess it, such as Finches, it appears when full as a bulge at the base of the neck above, not below as usual, and in birds of prey is most conspicuous, as it swells out through the feathers. Pigeons also have the posterior or grinding part of the stomach —the gizzard—which in many birds is not differentiated from the soft anterior or digestive portion,

particularly strong, and in some cases even provided with gristly or bony crushing-discs, in order to triturate nuts or the stones of fruit.

The strong gizzard of Fowls and Ducks is also well known; that of the Turkey is so powerful that in the experiments of Spallanzani, who more than a century ago conducted experiments without any regard for humanity but with unimpeachable accuracy, a leaden ball studded with small lancets was found after eighteen hours with its armature destroyed, while the gizzard was discovered quite uninjured, when the Turkey was killed. And among the Ducks the shells of the hard molluscs and crustaceans that such sea-haunting forms as the Eider-duck feed upon are speedily reduced by the action of the gizzard to a substance resembling sand. No doubt the gastric juice has something to say in this result as well as the extraordinary power of the muscular contractions of the stomach; for some birds with soft stomachs can do wonders in the way of reducing hard substances, such as bone.

I have, for instance, given to the Goosander (*Merganser castor*), a fish-eating Duck with a soft stomach like a bird of prey, no less than forty fish about the size of small sprats, at a meal, just to see how many he could take; and there showed no signs of bone in the droppings that were passed. I had a similar experience with another fish-eater, the Indian Dwarf Cormorant (*Phalacrocorax javanicus*), which also digests fish bones and all; a half-fledged young Indian Swift (*Cypselus affinis*) given

to one of these birds was also digested with its bones and growing feathers. The Shag (*Phalacrocorax graculus*) and the Indian Darter (*Plotus melanogaster*) also digest their fish bones and all, but the Common Cormorant (*P. carbo*) casts pellets.

This habit of pellet-casting is another that needs careful investigation; unfortunately in many cases it is necessary to keep the bird in confinement to ascertain these points about digestion, and in the case of pellet-casting one has to be on the watch, for the castings are not always thrown up every day. In some cases a species may be exceptional among its group, as in the case of the common Cormorant above noted; but commonly the casting of pellets or otherwise seems to be a group-character. It is very well-known among birds of prey, and the falconers of old were well aware that to keep their Hawks healthy it was necessary to provide them with some indigestible material with which the pellets might be formed, such as a tuft of wool dipped in blood to make it palatable.

The fish-eating birds of prey throw up pellets as well as the flesh- and fowl-eaters; so do the Kingfishers, both the fishing ones and the land-feeding forms like the Australian Laughing Jackass (*Dacelo gigas*); so do Herons, Gulls, Rollers, and Bee-eaters; and among passerine birds, Shrikes, Thrushes, Flycatchers, and no doubt others. But the habit is not universal, and whatever may be said about the impossibility of digesting chitin, I have noticed no trace of insect remains among the

excrement of such birds as Starlings and Babblers, which do not cast pellets either, so that it looks as if they were in possession of a chitin-solvent; though perhaps microscopical investigation might reveal comminuted particles of it in the dung.

Spallanzani found that a captive Eagle, though casting pellets, did digest some portions of bones introduced into its stomach in a perforated tube wrapped in meat as a disguise; it could also digest bread thus disguised, though it would not take it when openly offered, as Kites, even at liberty, will do.

The Lammergeier or Bearded Vulture (*Gypaëtus barbatus*) has probably the strongest digestive powers of any animal-feeder, since it habitually eats bare bones, coming to a carcass after the other Vultures have left it, and swallowing such bones as it can. Others it takes up into the air and drops on the ground, descending in order to eat up the fragments. It treats tortoises in the same way, and Crows and Gulls are known, by the way, to practise the same trick with mussels. The Great Adjutant Stork (*Leptoptilus dubius*) of India also swallows bones, but it does not wait till Vultures have left a carcass, but comes and drives them away from it, and gobbles down all it can swallow, flesh and bones alike.

The Lammergeier eats not only bones and flesh, but ordure, like the Scavenger Vulture, and a Desert-Chough (*Podoces hendersoni*) feeds on the dung of beasts of burden, not merely picking out undigested grain, as so many birds do, but swallowing

the matter wholesale. This brings us to the consideration of the power of some birds of eating, unharmed, food which would be not merely repulsive but poisonous to ourselves, and even to other birds. For instance, the poisonous nature of the skin-secretion of toads is well known; yet I have known the common toad (*Bufo vulgaris*) eaten with impunity by the Laughing Jackass, and the Indian toad (*B. melanostictus*), which I never saw touched by Kites or Crows, by the Crow-Pheasant or Coucal, Pied Hornbill (*Anthracoceros malabaricus*) and Indian Roller (*Coracias indica*); the last two birds, it is true, were in captivity, but the Coucal, which was a hand-reared one, I allowed to range free; but merely being in captivity will not make every bird eat so nauseous a mouthful as a toad, although under such conditions birds will often eat animals which are only moderately unpalatable, like some "warningly-coloured" insects.

Bee-eaters eat wasps, as well as bees, and are probably immune to the sting, though the crushing process to which they subject their prey may put this out of action. The Laughing-Thrushes (*Garrulax* group), in captivity at any rate, rub these stinging creatures against their own tail-feathers before eating them, and the Pekin Robin (*Liothrix luteus*), a smaller member of the same group of Babblers, treats black ants (red ones it will not eat) in a similar way. The object is no doubt to wipe off the acid exuded, for a lady fancier recorded in one of the bird-fanciers' papers some

years ago that a tame Starling did this with horse-radish which had been soaked in vinegar, a delicacy for which it promptly made when allowed to get to the meal-table.

A more natural proceeding, one would think, would be to rub the offending morsel on the ground, a proceeding I have seen a captive Babbler (*Crateropus canorus*) of mine follow out with a caterpillar, armed with most penetrating spiny bristles, before eating it. Such caterpillars, as well as the softer-haired ones, are generally avoided by all birds, but as is well known, the Cuckoo eats them so freely that its stomach gets lined with their hairs, and the common Cuckoo of America (*Coccyzus americanus*) has the same habit; as this is a non-parasitic bird, it would seem that the habit of eating food unpalatable or dangerous to other birds is older in Cuckoos than the parasitic habit.

When I was in Zanzibar in the early 'nineties I used every morning to see a pair of Glossy Cuckoos (*Chalcococcyx cupreus*) visit the little backyard of the hotel where I stayed to feed on the highly "warning-coloured" caterpillars of a moth of the same genus (*Euproctis*) as our "gold-tail," and the toad-eating Coucal is a member of the Cuckoo family, though not parasitic, like the American Cuckoo.

Every one knows that it would not be safe to follow the guidance of the birds in eating wild berries; a Hornbill, indeed, even feeds on the fruit of *Strychnos nux-vomica*, from which strychnine is obtained. Hutton also found, when collecting

birds in the Himalayas, that when he poisoned a carcass with this drug, the Eagles which fed on it were killed, but the Vultures flew away unharmed. Tristram also records that when a pet Griffon Vulture of his devoured the contents of a half-pound pot of arsenical soap, the only result was a violent fit of vomiting. It is not surprising, perhaps, to find such endurance of virulent poisons amongst Vultures, whose ordinary food consists of putrid carrion, for it is well known that putrid or sour food is very dangerous to most birds other than carrion-feeders, even if they can be got to eat it.

Some substances are taken in by birds for reasons that are at times hard to understand. The well-known habit of grain-eaters and some omnivorous forms, like Crows, of swallowing sand and gravel is easily explicable, since these substances aid the gizzard in comminuting the food; but it is difficult to see why Hawks, living on flesh, and casting up indigestible substances, should need to swallow gravel, which is shortly afterwards cast up again. As the stones are worn away by natural abrasion in the grain-eaters at all events, they are no doubt useful in supplying mineral matter to the body, just as the bits of shells and lime supplied to poultry are useful in providing shell-forming matter for the eggs.

Some birds also eat earth; a young Red-vented Bulbul (*Pycnonotus bengalensis*) I kept in India often did this, and I have seen a pair of an allied

race at the Zoo do the same; but I do not know if this is done by wild birds. M. G. Rogeron in his admirable work "Les Canards," credits Ducks with being able to extract nutriment from earth; he points out how eagerly tame Ducks ransack rain-puddles in a road after a shower, where there can be no animal or vegetable food to attract them, and recommends that earth be placed in the pans of water supplied to young Ducks which are being reared in confinement.

I myself have seen Mallard in Hyde Park on a wet day bibbling assiduously in a puddle on the path, and though Ducks when doing this may be only getting gravel, it would not be so very remarkable if they and other birds could utilize earth as food, as we well know this to be done by earthworms, whose digestive organs are very like those of a bird in miniature, with a crop and a gizzard stocked with minute particles of grit all complete.

It is not surprising that salt is liked by some birds, seeing the craving for this mineral is so widely spread; it is chiefly consumed however by vegetable feeders such as Parrots and Pigeons, the last being particularly keen on it. The Wood-Pigeon will drink salt water in order to obtain it; and whether it is liked or not, salt water must be drunk by the purely sea-birds such as Penguins, Auks, Petrels and marine Ducks like the Eider. Gulls, however, will come to fresh-water pools if they have the chance in order to drink the fresh water.

Many birds, however, are curiously indifferent

about water; either they do not drink at all, or only do so when water is easily to be had, not making a special search for it, and being able to do without it in captivity. There are the same differences among mammals, but it is curious that in this class the total abstainers are all herbivores, the carnivora drinking readily and regularly, while among birds it is most particularly the animal-feeding kinds which can dispense with the fluid, though some of the vegetable feeders can do so as well. Owls and Hawks, for instance, can live without drinking, though both do drink; in India it was a common sight to see Kites drinking at a pond.

Kingfishers seem never to drink, either the fishing or the land-hunting kinds, though I did once see a Laughing Jackass in the Calcutta Zoo make a sort of awkward attempt to do so. The aquatic-feeding kinds, like other fish-eating birds, no doubt swallow a good deal of water incidentally. This must, one would think, especially apply to those few favoured birds which have learnt the trick of swallowing under water, so familiar in the case of the Penguins in the diving-tank in the Zoo. Generally, however, a diving fisher comes up with its fish, but among the Cormorants one of the African species (*Phalacrocorax capensis*) can swallow under water, as also can the Shag (*P. graculus*).

It is a curious thing that Humming-birds, Sun-birds, and Honey-eaters should drink water so freely, living on liquid food so largely as they do;

the honey-eating Parrots are also free drinkers. Parrots generally, however, can do without drinking to a remarkable extent, and if supplied with moist food in captivity care little for water; it used even to be the custom to bring over the little Budgerigars (*Melopsittacus undulatus*) from Australia on dry seed only, with no water during the whole voyage, though under this cruel régime there was naturally a large mortality. It is a curious point about some of the Parrots, by the way, Cockatoos for instance, that their mouths are dry inside, there being apparently no secretion of saliva. In ordinary birds the supply is limited, just enough to moisten the mouth, and such a thing as dribbling or spitting rarely occurs as far as I have seen.

Hornbills and Bustards can also do without water; but I have seen both the Great Bustard and the Elate and Black Hornbills (*Ceratogymna elata* and *C. atrata*) drink in captivity; the action of the Hornbills was very awkward, as they pecked up the water as it were, an action also characteristic of the Rhea or American Ostrich (*Rhea americana*). It may indicate that the habit is a comparatively new one, or that it is being lost.

With the exception of Pigeons, Sand-Grouse, and the Gouldian Finch (*Poëphila mirabilis*) which drink in a continued draught like horses or cattle, the procedure of birds in drinking is very uniform, the water being scooped up in the lower jaw and allowed to run down the throat; nectar-feeders, however, lick up their drink with their tongues. It

is curious that the rapid and efficient method of continuous drinking above mentioned is confined to such a few birds, especially as there is nothing in the form of their bills and tongues to account for it; similarly birds which swallow food under water have no special mechanism for facilitating this—it is merely a matter of "having the knack of it" in both cases, evidently.

The Sand-Grouse, though essentially desert-birds, have never become independent of water like the Bustards, no doubt having been spoilt, so to speak, by their wonderful wing-power, which makes it easy for them to visit even distant watering-places twice a day; and they even water their chicks in a perfectly unique way, first observed and recorded in captive birds by Mr. Meade-Waldo. The male bird, which undertakes this duty, soaks his lower plumage in water and then goes to the chicks, which suck his wet feathers. The aviary bird of course had only to walk to his chicks, but the wild one must surely not have very far to fly to them if the device is to be of any use, since flying in the dry atmosphere of the places these birds frequent would soon dry the plumage. Generally speaking only birds which disgorge food for their young, like Pigeons, Parrots, Gulls, etc., can give them water, and it is not given in a special dose by these, so far as I am aware; the young get it incidentally, so to speak, with the food administered.

Birds often feed their nestling young on food different from that which they ordinarily eat

themselves, and even self-feeding chicks often show tastes in food different from those of adults. In almost every case the difference consists in the young bird's diet being more animal in character than that of the old ones ; thus, Finches, which live mainly on seed and other vegetable food themselves, are frequently very largely insectivorous when feeding young, as any one may see with the common Sparrow. I found also the young Bulbul I mentioned above would not swallow fruit if it could possibly help it, but gladly took flies and pea-meal paste (a common article of food for insectivorous birds among native fanciers in India), although the adults feed, I think, more on fruit than on insects. I have also referred above to the Red-eared Bulbuls catching dragon-flies for their young, though I never saw the adults eating these insects.

This habit of feeding the young on insects is a great stumbling-block to the class of fanciers, very numerous nowadays, who like to get their birds to breed in their aviaries, for birds are, in the case of species who believe in insects as a nursery regimen, so obstinate about it that they commonly refuse to use any substitute, at any rate during the early stages of rearing, and even, in the case of insectivorous birds, often give up eating the artificial mixture themselves. Probably the mental excitement due to parenthood produces a reversion to the state of mind of the newly-caught bird, which has to be gradually accustomed to the artificial diet, just as birds previously tame often conceal

their nests and act suspiciously towards their owner when nesting.

In some cases birds alter the diet as the young grow older; American investigators, for instance, have found that Grackles (*Quiscalus*) give the young as their first meals very tiny spiders, and I noticed that a pair of Indian Dabchicks (*Podicipes capensis*) I watched for years on our pond in the Museum grounds in Calcutta fed the young for the first week or so only on insects and small freshwater prawns, not on fish as well, as they did later on.

With regard to the tastes of active self-feeding chicks, every one must have noticed the extreme activity of young Ducks in capturing flies, which seem to form their chief food; and the young of the Tufted Duck (*Fuligula fuligula*) catch small fish; the Red Grouse also, one of the most limited of vegetarians when adult, feeding almost entirely on heather and bilberry, nevertheless is largely insectivorous when young, like the more omnivorous Pheasant and Partridge. Young Great Bustards are also far more animal feeders than the old birds, which are mainly vegetarian.

I do not know of any bird which is vegetarian when young and afterwards takes to animal diet, but many can live on vegetable food from the first, such as Parrots among nestlings and goslings among the active type of young birds; I also found that young Indian Barbets of two species, the Blue-cheeked (*Cyanops asiatica*) and the above-

mentioned "Coppersmith" could be reared quite satisfactorily on banana only, though, to be sure, I did not get them for this purpose till half-fledged. Among ducklings, too, those of the Mandarin, and sometimes the Wigeon, graze when quite tiny, as well as hunting for insects.

Birds certainly give some very queer things to their young at times; many years ago I saw at Oxford Starlings carrying bits of cherries which were not even quite ripe, to their young in the nest, so that I am not inclined to put down to confinement the action of some Indian House-Mynahs (*Acridotheres tristis*) I saw a few years ago breeding at the London Zoo, which regaled their offspring with bits of ivy leaves, though liberally supplied with insect food. Mrs. Johnstone, too, who first bred in this country the lovely Leadbeater's Cockatoo (*Cacatua leadbeateri*) of Australia, says they fed the young mostly on rotten wood, of all things, a jejune diet which makes M. Rogeron's suggestion that Ducks assimilate earth seem more probable.

But the queerest article of diet for young birds is that supplied them by some of the larger Grebes —their own parents' feathers; this is, of course, in harmony with the strange feather-eating habit of the old birds, which appear to be able to digest this strange diet, or at any rate to partially do so, since they do not cast pellets—as I know from careful observations on captive birds—and comminuted feathers have been detected in their intestines. I

have seen a Great Crested Grebe at the Zoo eat about half-a-dozen feathers in a quarter of an hour, as they came out when it was pluming itself; but I never saw Dabchicks either eat their own feathers or give any to their young.

A very rare and interesting habit is that of young birds feeding each other; I only know of two cases in which it is regularly done—those of the common Moorhen and apparently the Coot. In both cases it is the birds of the first brood, by this time nearly full-feathered but still unable to fly, which thus help their parents with the small downy chicks of the second batch; it is a common sight in the case of the Moorhens in the London parks, and it was in St. James's Park that I saw a young Coot feeding its junior. This case was a particularly curious one, because I saw the feeding young bird actually cry for food to the parent, and on one occasion eat what it thus got itself, and another hand it over to the small chick.

When rearing a brood of young Indian Rollers (*Coracias indica*) I noticed that, although so ravenous that when they saw me coming with the raw meat on which I chiefly fed them they would not only yell lustily but start fighting vigorously, yet a bird which had had enough would feed another one with the next piece given it; this, however, was, I expect, an abnormal piece of benevolence, chiefly prompted by the bird's dislike to give up what it had once seized, while it could not itself swallow it. Similarly, the instinct of birds which disgorge

to feed their young may often be excited by stuffing themselves; canary-breeders well know that the addition of a tasty item to the *menu* is the best way to start the old birds feeding the young ones vigorously.

One of the most touchingly human actions of birds is the feeding of each other by the sexes; generally of the female by the male, which is reasonable enough, since he has to conciliate her feelings, and any extra food that she may obtain without extra exertion is so much to the good, having in view the physiological demands made upon her during laying and sitting, to say nothing of the care of the young, in which she usually takes the chief part if not undertaking it altogether. Often the female is fed on the nest, as by the Rook; but this courtesy is often extended to her at other times, though more especially at the breeding-season; in fact, when one bird is seen to feed another, it is generally a sure sign of the pair having decided to enter on matrimonial affairs.

The sight is common among our domesticated birds; the well-known "billing" of Pigeons and Doves is merely the female being fed from the crop by the male, as the young are by both sexes; the Cock gallantly calls the hens to any morsel he has found, and when food is thrown does not eat until they are all served; Canaries are so keen on feeding something when in breeding condition that they will, when cocks are kept, as usual, singly, disgorge food on the perch and eat it again, and

Parrots will attempt to feed people for whom they entertain a peculiar regard. One may even see the Robin, solitary and selfish as it usually is, present a worm to its mate, and even among the Cuckoos, proverbial emblems of selfishness, I have seen the male of the Koel (*Eudynamis honorata*), the commonest species of India and a fruit-eater, give to the female berries plucked from the bough on which they were both sitting.

Here the action is the merest courtesy, comparable to our habit of rising to open the door for a lady; at the opposite extreme of supplying all the female's necessities is the action of the Hornbills, among which the hen walls herself into the nesting-hole in a tree with a plaster of her own droppings, while the cock feeds her through a slit left in this, enveloping his contributions in a gelatinous envelope secreted from the coat of the stomach—its epithelial lining, in fact; at any rate, such bags of food have been disgorged by Hornbills in captivity and it has been assumed, perhaps too hastily, that the action was normal in nature also. The Hoopoe, an ally of the Hornbills, also assumes the entire responsibility of the maintenance of the sitting hen, though he does not encapsule her rations nor does she wall herself into the nest.

One would naturally suppose that the habit of feeding the female would be generally adopted among birds; but it is doubtful if this is the case, and there are certainly many exceptions even among groups in which, as in the above instances, the

kindly act is well known to the most ordinary observer. It seems to be universal in the Pigeon family, indeed; but it certainly is not in the poultry tribe; the Guinea-fowl feeds his hen like the common Cock, and so does the Satyr Tragopan (*Tragopan satyra*); but the common Pheasant and Peacock do not, nor do the Gold and Silver Pheasants. Quails do it, both the Harlequin Quail (*Coturnix capensis*) and the pigmy Painted Quail (*Excalfactoria sinensis*); I have seen nothing more quaintly appealing in bird life than the action of a cock Harlequin Quail in one of the Zoo aviaries, which came up to me and the keeper who was showing me through, drawn up to his full height and looking with such an obvious request that I asked instinctively "What does he want?" "Mealworms," said my companion, "but not for himself—for the hen," and sure enough he honestly gave her every one he received.

Feeding the hen is, I believe, as universal among Parrots as among Pigeons; but it certainly is not so among Finches—although Goldfinches and Linnets and many others do it; Sparrows certainly do not, nor, I believe, do Chaffinches. But it is difficult to prove a negative, and the action is often confined to birds in the height of breeding condition, of which it is among fanciers the well-known index, as has been stated above.

Among birds of prey I have never seen a case, although Kites (*Milvus govinda*) were so common about Calcutta, and wife-feeding by their neigh-

bours and rivals, the House-Crows (*Corvus splendens*), was one of the commonest actions to be observed; but O. St. John saw one Kestrel feed another in Morayshire, and Mr. E. Selous has fully observed in Iceland the victualling of the hen Merlin by her mate when rearing young.

I cannot recall any case among waders and water-fowl, except among Terns, which feed the sitting hen and also make love-gifts when courting; probably the habit is pretty widely spread among such fishing-birds which seek food away from home, but it cannot be taken for granted. Among the Duck tribe, affectionate mates as these are, the action is almost entirely confined to the Carolina or Wood Duck of North America (*Æx sponsa*), which makes a show of his love-gift, holding his head and tail high up when offering it, this attitude being his display position. Neither Geese nor Swans, though life-pairers and very devoted, ever seem to feed their mates at any time.

It is a curious fact that in at any rate some cases, when the rôles of the sexes are reversed, and the male incubates and cares for the young, the female is so masculinized that she not only fights for the male but feeds him; at all events, this was observed by Mr. D. Seth-Smith, the Bird Curator at the Zoo, when as a private aviculturist he bred two species of Hemipodes or Button-Quails (*Turnix*), Quail-like birds in which the hen is the superior sex.

As this is not usually the case in birds which

build tree or rock nests and have helpless young, female feeding must not be looked for here, although an observer of the home life of the Peregrine Falcon has noted that the hen, the larger and stronger bird, as is well known, supplied her smaller mate with food for the young, part of which he incidentally ate himself—a case exactly the opposite of that of the Merlins observed by Mr. Selous, although the two species are not remotely related and present just the same kind of sexual difference —with the advantage in size on the female side.

Except when it goes so far as feeding the sitting or rearing hen and the young, it is doubtful whether this habit has any survival value of importance— it is merely the outcrop of kindliness of nature, similar to that which restrains some birds, such as the Cock and the male of the Cotton-teal (*Nettapus coromandelianus*) from retaliating on a female under attack from her.

That it has little utilitarian significance is shown by the fact that the selfish Pheasant can seduce away a hen from the gallant and generous Cock if he can conquer him in combat, which is usually the case with all breeds of poultry but the Game; and the Carolina Duck will sometimes mate with the related Mandarin Drake, though this bird's idea of politeness to the female, even of his own species, does not go further as a rule than not rudely squabbling with her for a morsel. I must admit, however, that I have once seen him go so far as awkwardly to drop the bit and let her take

it, but generally speaking, his extreme ostentation, combined with an inconsiderateness not shown by the more modestly and tastefully attired Carolina, looks as if it were designed as a satire on the human dandy, notoriously the worst and most indifferent of husbands. The parallel, however, would be a dangerous one, for except in generosity, the Mandarin yields little if at all to his American cousin as a lover.

CHAPTER V

Propagation—Care of young—Different types of young birds—Different modes of feather-development, as seen in young Fowl, Pigeon, or Duck, for instance—Egg-coloration and its meaning and variations—Prolificacy and otherwise—Incubation mounds—Periods of incubation.

THE care of old birds for their young has always attracted the attention of humanity, and one of the best known allusions to nature in the Bible is the text that speaks of the fowl gathering her young under her wings. As one would expect, it is generally the hen that has most to do with the incubation of the eggs and the nursing, so to speak, of the young, while they are still so small and weak that they need to resort to a parent for warmth, being unable to keep up their temperature by themselves.

This performance on the part of the parent is termed brooding or "hovering," and in the cases where it can be watched, as in birds which brood their active young on the ground, it will be seen that the parent sits down on its heels, while the young run under and are sheltered by the plumage of the breast and sides. In the case of a young Avocet that was hatched and reared at the Zoo some years ago, it was interesting to see how the little

thing would stand up under its long-legged parent, whose body was not very near the ground even with the legs bent, so that only its little legs were visible, the body being concealed in the parent's feathers.

Some birds, however, may brood their young on the back under the wings, like the common Mute Swan, in which this seems to be the habit of the female only ; in the case of a pair of the South American Black-necked Swan (*Cygnus melancoryphus*) which bred at the Zoo some years ago, however, the male carried the cygnets in this way quite as often as the female, but this may not be normal with the species, as I never saw the male of the Kew pair do it when he had young—he seemed to spend most of his time in making unprovoked attacks or at least threatening naval demonstrations against the Geese.

In Grebes the young are habitually carried in this way on the back of the swimming parent, at any rate at first, and I have been able to observe in the case of the Indian Dabchick (*Podicipes capensis*) that the parent when brooding them on the nest at night also takes them on its back there ; certainly the wet nest would be a most inconvenient and probably unsafe bed for them, as they are far less hardy than young Ducks, and even these can easily have too much wet. Both of the pair of Dabchicks I watched carried the young, but especially the bird I took to be the female, although it was the larger ; coloration in Grebes is no help in fixing the sex. While one bird carried the

chicks, the other hunted for food, so the co-operation was perfect.

In many species, however, one sex does everything or nearly so, and this is generally the female, as remarked above, but extra-fatherly male birds occur, which take over all the ordinarily feminine duties. These comprise nearly all the "Ratite" or primitive flightless birds—the Emu, Cassowaries, Rheas, and Kiwis or Apteryxes, but not the true Ostrich; the Partridge-like Tinamous of South America, which, although flyers, are really "ratites" by anatomical structure, with the exception of the keel on the breast-bone; the Hemipodes or Button-Quails, and the little Coot-footed Sandpipers or Phalaropes.

It will be noticed that although some of these birds are enormous in size, none are remarkable in any other way, so that the inference is pretty plain that feminism in the bird world, though quite a workable arrangement for reproducing the species, is not the way to produce a high type of birds, the great "runners" being merely lumbering degenerates except the one which has resisted feminism, the true Ostrich, which is a magnificent creature in his way, and holds his own in a region full of formidable mammals, both carnivores and herbivores.

The so-called American Ostrich, the Rhea, seems to have got into a curious mixture of rôles in his family affairs; unlike the Emu and Cassowaries, in which the males are purely feminine in char-

acter, while the larger females are quarrelsome and non-incubators, he is larger and fiercer than the hens, and fights fiercely to win them from rival males, whereupon the ladies pool their eggs in the nest he scratches out, and leave all the rest of the work to him. A cock Rhea might have been seen in the London Zoo at the time of writing this, proudly escorting a brood of young, whose mother cared so little for them that she had to be driven away from the special food provided for their delectation, which the father hardly touched; this eating of the young birds' food by the indifferent mother being apparently the usual thing in such species.

Generally, of course, if there is an indifferent parent it is the male especially if decorated; Cocks and Drakes, for instance, do not aid their mates in rearing the family, but the habit is not constant in groups. Male Partridges and Ganders protect the young, and the former even brood them; male Swans also sedulously guard their cygnets, as male Sheldrakes do their ducklings.

In many birds there is a very fair division of labour, as with Pigeons, Sand-Grouse, and the true Ostrich, the cock doing half the work if not even more. Among the domestic Pigeons and Doves, for instance, it will be noticed that while both feed the young indiscriminately, the sitting is very evenly divided, the cock sitting from about ten in the morning till about five in the evening, while the hen takes the rest of the time, and has perhaps the best of the bargain, as she would

have to sit quiet at night in any case. In the Ostrich and Sand-Grouse the reverse is the case, the hen sitting by day and the cock by night; the cock Ostrich, however, is said to show more solicitude about the young than the hen, and in the case of the Sand-Grouse it is the cock that waters the chicks as above described.

The feeding of the young of Pigeons is accomplished during the early infancy of the "squeakers," to use the fanciers' appropriate technical term, by a curd-like substance actually secreted from the walls of the crop in both sexes; and as this, except for the absence of sugar, closely agrees with milk in chemical composition and properties, the old First of April expression "Pigeon's milk" is something more than a mere joke. As the birds grow older this is mixed with half-digested food, and the secretion ceases altogether long before the birds are reared.

Pigeons, by the way, feed their young by taking the bills of the young, which are soft and much bulged at the base, into their own, and pumping up the food into their mouths, whence the young suck it down; the method employed by Parrots is similar, and so is that of the Ibises. Very awkward indeed it looks, too, when the young Ibises are fledged and still want feeding, for though the bill of the nestling Ibis is not much longer than a young Pigeon's, it is nearly full-length when the bird leaves the nest, and it looks a most unpleasant proceeding for the old bird to have a long bill

thrust unceremoniously down its throat. But in the case of Penguins and of the Pelican group, including Cormorants and Gannets, matters go much further; at any rate the young bird does, for it gets its head and even neck well down the long-suffering parent's gullet.

I well remember in Calcutta getting hold of a fledging young nestling of the Darter or Snake-bird, which was brought to the market for sale half-reared. It was charmingly tame, but the head, at the end of its long slender neck, wobbled most provokingly when I tried to feed it, so that, eager though it was for the fish I offered, it was a difficult matter to get one placed in its mouth. The obvious move that suggested itself was of course to hold the wobbling head in one's hand to steady it; and to my intense surprise, as soon as I did this, the bird's mouth suddenly expanded to about twice its previous size, so that it looked like a funnel. Obviously the clasp of my hand reproduced the pressure of the parent's gullet, to which the nestling instinctively responded.

Since then I have read an interesting note by Miss R. Alderson, a keen amateur of Doves, about her difficulties in getting food into the mouth of a very young Dove-nestling she was rearing, until its beak happened to slip between her fingers, when it opened it at once, and was thereafter fed quite easily; evidently in this case a little pressure to represent the feel of the parent's bill was all that was needed.

The method of putting the beak and often a good deal more, as we have seen, inside the parent's mouth, is, however, not the usual one with nestlings which are fed by the parents; the more popular method is for the young to gape and the parents to place the food in their open beaks, whether they disgorge it or bring it in morsels. This may be seen in the case of Canaries, Sparrows, and small birds generally, to say nothing of less familiar creatures like Hawks, Owls, Kingfishers, Rollers, etc. Nightjars grip the bill of their parent with their own, and young Storks, judging from the behaviour of specimens which are reared now and then at the Zoo, expect the old birds to throw up the food into the nest, when they pick it up and swallow it—a most insanitary-looking proceeding.

Generally speaking, nestling birds have no idea of picking anything up till they are nearly fledged, sometimes not till after they can fly, and would starve in the midst of plenty through not dreaming of stooping to pick up their food. Cuckoos are particularly slow in learning to pick up food, and in nature seem to be thoroughly spoilt by their foster-parents. They are especially ravenous, and this applies to the non-parasitic "Crow-Pheasant" of India, as well as to the parasitic species.

Even among our few domesticated birds we are well acquainted with two different types of young, which may be conveniently called active and passive, the "nidifugous" and "nidicolous" young of ornithologists; the latter, about which I have

been speaking above, being exemplified by the "nestling" young of Canaries, Budgerigars, Doves, and Pigeons, while our ordinary poultry, with their active running or swimming chicks, exemplify the former.

When we study the bird class family by family, we shall find that the cleavage between these two types of nestlings is very definite and complete; that is to say, they never both occur in the same family. All young Pigeons, so far as is known, are as helpless as those of the common Pigeon, even in the case of those Ground-Doves found in America and Australia which so closely resemble Partridges in general habits; and all young of the Duck family, from the grazing Geese to the fishing Mergansers, are as well able to "paddle their own canoe" as the familiar domestic duckling.

The two types crop up independently, moreover, in very distinct families; no one would think of classing Pigeons and Hawks together because they both have helpless young and feed them, or putting Fowls and Ducks in the same group because in both cases the young are active and more or less independent. It will be seen that the two types of young have no relation to the general habits of the parents, whether carnivorous or vegetarian, terrestrial or aquatic; the production of one or the other type may be regarded as a minor habit, generally connected with the style of nest or nesting-site used. Thus, birds which have a well-developed perching foot, such as Pigeons, Herons,

Cormorants, and Parrots, to say nothing of the numerous tribe of Passerines, generally build above ground on bushes, trees, or rocks; and such will naturally enough have helpless young; those which have the foot only formed for running or swimming, and the hind-toe very small or absent, are naturally less apt to perch, build on the ground as a rule, and have young which are active runners or swimmers.

It thus becomes possible in most cases to predict the probable nature of a previously unknown bird's young by the structure of the adult's foot; but such detective-story methods in natural history are to be employed with great caution, and in the present case, as might be expected, exceptions occur. To take the flightless birds, for instance, the rule works out all right with the flightless runners, from Ostrich to Apteryx, all of which have non-grasping feet with the hind-toe absent in all but the last; but it fails when we turn to the Penguins, which have a dwarfed useless hind-toe, even situated on the inner side of the foot, and yet have young which are helpless nestlings, in spite of the labour thus entailed on the flightless parents in trudging to and from the sea to get supplies for them, a labour in which the male is as earnest as the hen.

Among the flying birds, too, we find that in the Petrels, which are by no means perchers, having the hind toe reduced to a nail, and breed more often in holes in the ground than anywhere else, that the young are helpless and fed with an oily substance disgorged into their mouths by the parents.

Then on the other side, there is at least one family of tree-haunting and high-nesting birds which has active young, that of the Curassows and Guans (*Cracidæ*), perching game-birds with gripping feet, which take the place of Pheasants and their kin in the forests of the warm parts of America. The chicks here are fed by the parent for a day or so at any rate, judging from the behaviour of captive specimens, and they are hatched with the wing-feathers as well developed as in a chicken a fortnight old; it seems that they follow the parents along the boughs and creeping vines—so I was told by a naturalist, who said the chicks could be caught by shaking them down; no doubt this is one reason why so many of these birds are so extraordinarily tame in captivity; they have presumably been hand-reared after such a method of capture.

Some of the typical game-birds, for instance the Javan Peacock (*Pavo muticus*), the Tragopans, and also the Argus, have the quills well developed at birth, so that there is not such a great gap between more ordinary game-birds and the young of the Megapodes or Mound-builders, which are hatched with wings quite full-fledged and fit for immediate flight, though the body is downy. These represent the extreme of precocity in modern birds, and are the most independent of all young ones, since the parents take no trouble about them at all, as, being able both to feed and to fly, as well as to run, all they need to gain is experience and size in order to be as good as any adult.

The Game-birds, then, typify one method of fledging, which is found among few others than them, that of the wings developing long before the rest of the plumage. Even our domestic chickens show this well, although not "able to fly in a few hours," as a much-respected authority stated. Chicks of this type pick up most of their food, though the hen often draws their attention to it; young Peafowl and Turkeys do not begin to feed for a longer period after hatching than Fowls, a peculiarity which is no doubt the reason why poultry-keepers stigmatize Turkey-chicks as stupid, and needing to be "taught to peck"—the real reason being that the yolk in the intestines at the time of hatching lasts them longer than it does Fowl-chicks, though even these need nothing for the first twenty-four hours.

Besides the Game-birds, Hemipodes, and Tinamous, the Rhea and the common Cape Penguin (*Spheniscus demersus*) exhibit the peculiarity of fledging first on the wings.

At the other extreme of precocity comes the Fowl's domestic companion, the Duck; ducklings are even more lively than chickens, need less brooding and for a shorter period, and are more enterprising in foraging for food, on land as well as in what is popularly regarded as their only proper element. In fact, a poultry-breeder once complained to me that ducklings of the Indian Runner breed simply ran away from the old hens who were acting as foster-mothers, who could not keep up with them,

young ducklings being notoriously insubordinate, at any rate to hens, though they will listen to a Duck mother if she calls to them.

But in spite of their independence, which is greater than that of any young birds other than the Megapodes, the fledging of young Ducks is most curiously slow. They grow and grow, and lose all their chubby infantile prettiness, and get more than half as big as their parents before any feathers come at all; and even when these do appear—on the shoulders first, and then the sides of the breast—the wings remain very tiny, out of all proportion to the powerful legs, and do not enlarge and sprout quills till the bird is full-feathered almost everywhere else and is nearly full-sized; this is the stage when the birds are known as flappers. Geese and Swans also develop in exactly the same way.

Some other water- or marsh-birds show a similar slowness in growing feathers to replace the down, and in the enlargement and quill-growth of the wings; these are the Rails—as any one can see in the case of the young of the common Moorhen and Coot—the Cranes and the Grebes. Young Grebes have a special remarkable peculiarity of their own in fledging; the head-feathering "hangs fire" longest of all the plumage, so that a Grebe may be full-winged and downy-headed at the same time, a very rare case among birds, though a similar one is found among the young of the Cranes. So far as is known, this retarded fledging, like the precocious fledging, runs through the family wher-

ever it occurs; it will be noticed that except in the case of the Penguin, these methods of fledging are only found in families which have active chicks.

The third method of fledging is that which occurs in the vast majority of birds, and is what one would have reasonably expected in all of them; that is to say, the feathers grow pretty evenly all over the body, and the wings develop in size like the legs, and grow their quills pretty nearly as quickly as the body-feathers, and much more so than the tail, which goes ahead in the case of the retarded fledgers of the Duck and Rail type; our Pigeons, Doves, Canaries, and Budgerigars furnish familiar examples of this, as well as such wild birds as Thrushes, Sparrows, etc.

But these are all birds with helpless young; and the uniform method of fledging, being so prevalent, is also found among birds whose chicks are active, such as Plovers and Gulls. Some people, indeed, regard the young Gull as intermediate between the active and passive type of young bird; but as it is able to walk about, even when quite small, and can pick up the food the parent vomits for it, even if it does not provide for itself, it can fairly claim to be put on the active list.

It is, however, often hatched in a nest which puts pedestrian exercise out of the question, as when this is on a ledge of a cliff, and so there is certainly a tendency in young Gulls to degenerate towards the passive type. This is so also with their diving relatives the Auks, but even these, cliff-

dwellers though they are, can walk, and pick up fish, etc., where brought by the parents—which do not swallow and vomit it, but carry it in the bill —and in the case of the Guillemot, at any rate, go down to the sea when half-fledged, their fledging being uniform as in Gulls, though this premature jump into existence results in the death of many.

The young of that most curious bird the Cariama (*Cariama cristata*) also seems to show a partially degenerate type. It lies quietly in the nest, which is built aloft, though the old birds spend most of the time on the ground, but yet has patterned down, dark brown with a cream streak down each side of the back and cream spots upon the brown; and as such down is usually found in runners, it presents to the eye a queer blend of the two types of young; but the young one I observed, bred at the Zoo, left the nest long before it could possibly fly, though perhaps this was premature. At any rate it climbed back to it when a bough was placed as a ladder, so the same thing may occur in nature, the nest being in a tree; it did not seek for food, but waited till the old birds gave it, just as Moorhens and Coots do when they are very young; and they keep taking it from the parents at times even when fledged, as this young Cariama did, and thus show, on their part also, signs of pauper degeneracy.

In fact, the feeble, whining squeak and imploring attitudes of the young of the Rail tribe contrast very unfavourably with the liveliness of their frequent companions, the ducklings; in the case

of the New Zealand Weka Rail, the parents, which are flightless ground-birds, have been seen running to and fro until quite weary, plying with food their young which they had left in a place of safety.

Grebes, again, nursed on the parent's back and fed there or on the nest for a week or so, come very near being mere nestlings, and are very feeble at first, unable to do more than crawl, and unwilling to swim; and the Swans' cygnets are not nearly so active on land as goslings and ducklings, though downy and swimming well enough; and as their parents carry them on their backs, at any rate at times, and do something to feed them—the Mute Swan, as is well known, pulling up weeds for them, while the Black Swan, as I have seen, will pull them grass from the bank—these young also seem to approach nearer the nest-fostered type than the active majority of the family.

Indeed, the young of several members of this group are much more active and enterprising than their parents; young Mallard frequently dive for food like young Tufted Ducks and Pochards, even up to the flapper-stage, though adults very seldom do so, and they are also very much more active on land; young Sheldrakes of three species that I have watched, the Common (*Tadorna vulpanser*), Ruddy (*Casarca rutila*), and New Zealand (*C. variegata*), dive most freely for food during the first week or two, while I have never seen the adults of any of these species do this, while they readily turn tail-up in the usual Duck manner, although in the ordinary

way they are more land-feeders than Ducks generally. So are common Wigeon; and I have seen their young ducklings dive for food, but, curiously enough, not Mandarin ducklings, though the old birds will dive for food more readily than any other surface-feeding Duck—indeed, I have seen them do so more freely than at least two of the diving Ducks—the Rosy-billed (*Metopiana peposaca*) and Red-crested Pochard (*Netta rufina*).

What habits the young of the curious Magpie-Goose may have do not seem to have been recorded; it would be interesting to know if they fledge late like the rest of the family.

Flamingoes, by the way, show a distinct difference from the Ducks in this respect; they fledge early and gradually, the wing quills developing in good time, just like the young of Storks and Ibises, to which, as I said above, they appear really to be allied. Their young are fed with disgorged food from the beak, at any rate at first, just as in these members of wading groups.

Quite the most curious instance of parental aid given to active young birds is that of the Woodcock, which carries its young from the dry wood in which they are hatched to the moist feeding-grounds, gripping them between the legs, which are in this bird very short for a wader, not longer, in fact, than a Partridge's. Even when the young are so far advanced towards maturity as to be bigger than a Snipe, the habit is kept up.

Another instance of active young being carried

in the parent's feet is that of the young of a very common Eastern water-fowl, the Small Whistling Tree-Duck (*Dendrocycna javanica*), which commonly breeds in trees, and has been seen to bring the young ducklings down in that way. The tree-breeding habit occurs frequently in Ducks, especially in tropical climates, and our Wild Duck frequently breeds in pollard willows or on decayed stumps, but the young in such cases generally jump down and take their chance, though M. Rogeron records one case in which he saw the old bird carry down the young in her bill, as the American Wood-Duck or Carolina Duck (*Æx sponsa*) is said to do.

I have heard, however, of a case in which the nearly related Mandarin Duck, breeding at large on an English estate, nested in a hole about fifty feet above a hard carriage drive, and the young simply jumped down and sprinted off for the water; of course young Ducks are very light, and thickly padded with stiff down, and so can take risks of the kind better than might be supposed. But the power of resistance of even adult birds of such a kind to a fall must be great; I have known an adult Carolina Duck escape from the former zoological sale-collection on the terrace at Covent Garden and fall (being pinioned) on the hard stones beneath, and yet not be injured.

A curious instance of a young bird of the active type in appearance being nevertheless a nestling in habits is that of the young of the South American

Sun-Bittern (*Eurypyga helias*) which bred in the London Zoo at the zenith of that institution, when it was under the Sclater and Bartlett management, and really excellent results were got there. This bird is described as being like a young Woodcock or Snipe in appearance, with variegated down, and it did not gape or cry like young birds generally, but when the parents flew on to the nest, which was at the top of a pole, with a small fish or other food in their bills, it snapped or pecked the morsel from them and devoured it.

The Sun-Bittern is not well-named, for, in spite of its carnivorous and wading habits, it is not at all like a Bittern, and forms a family of its own, related to the Rails; evidently it is a bird whose young are degenerating into the nestling type.

Within this type are to be found, as will be inferred from what has been said, varying degrees of degeneracy; young birds of prey, for instance, can seize with their feet and tear up food before they are out of the down. They will even walk about a little, if their surroundings permit, while in this stage, and so will young Penguins and even Pelicans, though in the case of the latter there is often little chance, as these birds as often as not nest on trees. Young Nightjars are also quite able to run, and do so for short distances.

Young Larks may be perhaps returning to an active condition, as they will ramble away from the nest before fledging; Mr. W. Farren has amusingly described in a recent number of *Wild*

Life how young Woodlarks venture away for a few feet from the nest when alone and undisturbed, and then, when frightened, shrink back to it, as if attached to invisible strings of elastic which pulled them back by contraction. This tendency to "reverse engines" is very marked among many nestlings, and is no doubt connected partly with the habit of backing to the edge or opening of the nest in order to discharge their dung, a piece of instinctive sanitation, and with retirement on alarm without turning round.

It is particularly well marked in young Kingfishers, which run backwards in a most comical way. They are provided with a pad on the hock-joint, on which they rest, like so many young birds, in repose; but it is not nearly so well developed in them as in young Woodpeckers and Barbets, which have a very marked horny-studded heel-cap, and, as nestlings, do not move on their toes at all, but on the heels, as I was, I believe, the first to record, having reared the Indian Gold-backed Woodpecker (*Brachypternus aurantius*) and two Indian Barbets—the Blue-throated (*Cyanops asiatica*) and the Crimson-breasted (*Xantholæma hæmatocephala*)—from the nest, and so noted not only the occurrence of the heel-pad (which had been previously observed in the Wryneck), but also its function. Such a pad has since been observed by Mr. Seth-Smith in the young of a Toucanet (*Selenidera maculirostris*).

These young Barbets, by the way, had a pecu-

liarity I never observed in any other nestlings: they kept their tails turned over on their backs, and under their closed wings; a most admirable arrangement for the tight packing which is the lot of nestlings reared in holes hacked out in trees, as young Barbets are, but nevertheless young Woodpeckers have not the habit, though similarly placed.

The nestling most celebrated for its peculiarities is that of the Hoatzin (*Opisthocomus hoazin*) of the forests along the edge of some rivers in northern South America. The adult bird is not unlike a perching Pheasant in general form, size, and habits, but the young are most curious creatures, clad at first in a scanty down like that of a young Pigeon, but nevertheless born open-eyed, not blind as Pigeons and other naked or nearly naked nestlings are; they are also able to clamber about the boughs, in which action not only the bill and feet are brought into play, but also the wings, which have claws at the end of the first and second digits, the first digit in birds being that little movable point which supports the set of pigmy quills known as the bastard-wing, which may be seen projecting at the pinion-joint of a Pigeon's wing when it is about to settle, and the second forming the tip of the pinion.

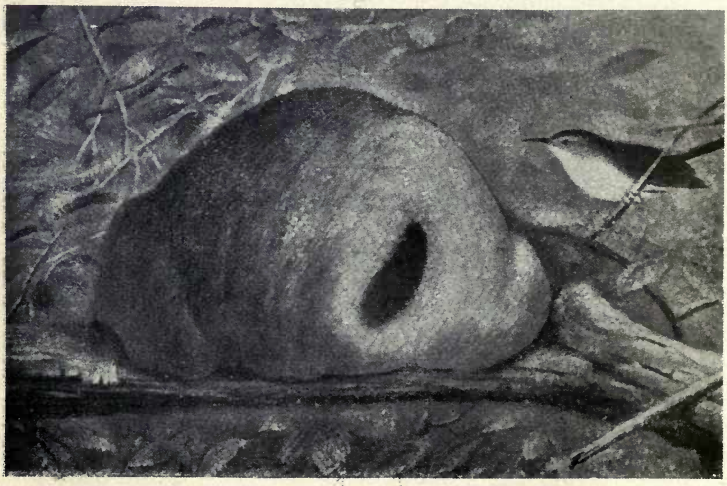
These claws of course represent two of the three original claws found in the separate digits of the primæval birds' forelimb (which were probably simply enclosed in a common skin like a Kingfisher's toes), and so it is interesting to find them still in

YOUNG HOATZIN.

A half-fledged specimen, showing its method of climbing with bill, wings, and feet.

BRUSH-TURKEY.

This is one of the largest of the mound-birds, and the only one commonly seen in captivity.



OVEN-BIRD.

The Oven-bird is brown and white, about the size of a Thrush, and has the strutting gait of a Bantam cock.

use in a modern bird, if only during youth, for as the bird gets older and fledges, which it does in the usual uniform way, the claws are shed. This is curious, because in the Ostrich, which is ages away from any perching or climbing ancestor, being not only flightless but having lost not only the gripping hind toe but also the one next to it, the wing-claws are retained throughout life.

The peculiarity of the young Hoatzin is not so unique as might appear, for the young of the Touracous (*Musophagidæ*), with which it used formerly to be classed, also pull themselves about their nests with their wings, as was first pointed out by Sir Harry Johnston, and confirmed by Mrs. Johnstone from observation on a specimen bred in her aviary.

Young Moorhens and Porphyrios also use their downy wings (which have a claw on the first finger) in scrambling about, and young Grebes—at any rate young Dabchicks—can during the first week or so of their lives only get about in this way on land, or rather on the nest, which is all the land they know. The really most interesting point about the Hoatzin, then, would appear to be that it is apparently a link between the nestling and the chick types of young, having the imperfect clothing so common in the former and the active habits of the latter, though we are not told if it feeds itself at all.

So distinct is the separation between the two types that there is only one case in which the

young of one family differ in type from those of another nearly allied to it; this being that of the young of the Sand-Grouse (*Pteroclidæ*) which are active runners, though with a very different type of down from that of young game-birds proper, it being more like true feathers. Yet the Sand-Grouse are supposed to be allied to the Pigeons, in which the young present the consummation of the helpless type, blind and pap-fed, with the down nearly always scanty, and sometimes even wanting, as in the bare black young of the Nicobar Pigeon (*Calœnas nicobarica*), which reminds one of a new-hatched Cormorant, Cormorants and Gannets being bare at first and downy later on.

But the Plovers are also a related group, and these the Sand-Grouse approach in their aborted hind toes, in their flight and notes, and in laying spotted eggs on the bare ground, as much as they do the Pigeons in their short legs and vegetarian habits. Those Pigeons also which have adopted a ground life and assumed a coloration strikingly like that of Sand-Grouse, nevertheless do not resemble them more than other Pigeons otherwise, so that possibly the Sand-Grouse are not so near Pigeons as some anatomists have made out.

There is only one family of birds in which the young are not definitely known, and that is the extraordinary little group of Finfoots (*Heliornithidæ*), of which only three species are known, all from warm climates, one African, one East Indian, and one South American. In appearance and

habits they are a strange blend of Rail and Cormorant, and all we know about their young is that Prince Maximilian of Wied once shot a male of the South American species (*Heliornis fulica*) carrying two naked young under its wings. A male Dabchick might have been doing this, but the queer thing about the Finfoot's young is that they should have been naked, since such young always remain in the nest; further information is certainly much to be desired, but the Asiatic bird seems everywhere rare, and nobody has taken much trouble about the African and American species, though both have been kept in captivity, one of the former having even been brought to England by Mr. J. D. Hamlyn.

Besides the inactivity of passive nestlings, the absence or very slight development of down in many of them is very striking, and their extremely repulsive appearance when thus clad, or rather unclad, makes it easier to understand the descent of birds from such an unpopular class as reptiles. "The young at first are perfectly bare and very hateful," is the remark of Russ on the young of a little Finch, as quaintly translated by Dr. Butler in his book on foreign cage-birds.

But there are gradations of this in the same family; for instance, among the Passerines, the young Lyre-bird is well clothed with down, and Mr. W. Frost tells me that he finds the young of the pretty Thrush-like Pittas, at any rate the Aru Islands species, are so as well; Canaries and Robins have a little down, but Sparrows and Crows none.

Among Parrots, young Cockatiels and Keas have down, but Budgerigars and Ring-necked Parrakeets are bare. So, apparently, are all Kingfishers, Rollers, Woodpeckers, and Bee-eaters, but Hoopoes boast of "a little bit of fluff," though Hornbills are naked. Nightjars are downy, and so are Owls and Hawks, the down of Owls being in most cases in two crops, the first one white, like that of most young Hawks, while the second one is coloured and often barred. Curiously enough the young of the Snowy Owl is black, like that of the White Tern (*Gygis*), and the goslings of the Snow-Goose are very sooty-looking little things—at least hybrids between the white and blue-grey forms are.

Among the Geese, uniform though their life-habits are, all being big strong wary birds, living in the open, able to swim, and feeding on vegetable food, there is a remarkable variety of down-colour and pattern in the young. Some are nearly self-coloured, olive ranging into yellow, as in the case of the common Grey Goose (goslings are only all yellow when the offspring of a white tame Goose, just as all yellow ducklings are the offspring of tame Ducks), or into black, as in the Snow-Goose; and some have a strong contrasted pattern, dark over most of the upper part and white below, as in the Bernicle, while in the highly specialized *Cereopsis* the goslings are striped light and dark.

Generally speaking, however, patterned down—striped, pied, marbled, or spotted—is characteristic of active chicks, while the passive nestlings, when

they have down at all, have it self-coloured, usually black, white, grey, or buff. There is an interesting exception, however, in the case of the Osprey among birds of prey, whose helpless young have variegated down, although in such birds the down is generally white.

Among the birds with active young, too, there are conversely groups or species which have self-coloured down; young Rails are black, young Cranes tawny, or, in the case of the splendid Stanley Crane of South Africa (*Tetrapteryx paradisea*), grey, and cygnets grey or white. And among the Game-birds, which so generally have striped down, that of the young chicks of the desert Seesee Partridge (*Ammoperdix bonhami*) is plain buff; and so is that of Hemprich's Gull (*Larus hemprichi*), which breeds on the scorching rocks of the Red Sea.

Taken into consideration with the fact that the young of the common Fowl, which are naturally strongly striped, as may be seen in the young of such breeds as the Brown Leghorn, which are coloured like the original Jungle-Fowl, generally appear in buff, black, yellow, or grey down, the conclusion seems at first irresistible that in the case of patterned chicks the pattern is necessary for protection, and that where security does not depend on coloration, it tends to disappear. Thus, the Cranes and Swans are strong birds and can protect their young and the Rails are clever skulkers and never go far from cover, so that the young of these may have lost the pattern just as nestling birds

have, it having become unimportant. The sandy young of the Partridge and Gull above mentioned might be cited as important confirmatory evidence, their exceptional plain colouring being in this case just what was wanted for protection.

It is also well known that the chicks of most ground-birds instinctively crouch when alarmed, after the fashion of most assimilatively coloured creatures. But on the other hand there are several cases in which birds of similar habitats have widely different down-coloration, and the reverse; some have been mentioned in the case of the Geese, and among the Ducks we find that the young of the Tufted Duck and Pochard, very similar in habits and diving power, and breeding on the same waters, are very different in the down, the young Pochards being patterned, very like the young of the surface-feeding Mallard, and the young Tufted nearly all black. Conversely, the ducklings of Mallard and Muscovy Ducks are both patterned in black and yellow, and yet the former never breeds in the tropics in a wild state and the latter is essentially a bird of the hot zone of America, so that their environments must differ much more than those of the Pochard and Tufted Duck.

Emus are more strongly striped in the down than any other young birds except Grebes, and one could hardly have birds more widely separated in habits, Emus being almost the biggest of land runners, and Grebes the most aquatic of all birds, and of moderate or even small size.

In any case, it will be noticed that the down of young birds resembles the fur of beasts in colouring, just as it does in texture, though the latter resemblance is of course superficial, down being merely a specialized form of feathers. No adult birds are longitudinally striped to the extent that chicks often are, but such a marking is not uncommon in beasts, such as the striped squirrels of Asia and America, and the striped mice of Africa, to say nothing of the striped young of most of the wild pigs. The marbling of certain chicks, and the spotting of others, may be compared with the varied coats of cats and civets, and, most interesting of all, it will be seen that chicks exhibit no colour which is not found in mammalian fur, however brilliant their feathers may be when they grow up. Black, white, and grey, chestnut, brown, and buff, are almost all their tints, and the only bright one they show, yellow, is just that which is permitted to beasts; visitors to the Zoo will recall the yellow beard of the Mandrill and the yellow whiskers of the Moustache Monkey (*Cercopithecus cephus*), to say nothing of the self-yellow coat of the Lion Marmoset (*Midas rosalia*) which surpasses that of any duckling. Several weasels also boast of yellow throats and breasts, and squirrels almost rival the gayest monkeys in brilliancy of tint.

Moreover, young birds, like mammals, may display other bright colours if these are limited to the skin, or at any rate to featherless parts. The red on the head of young Coots and Grebes may be

compared to that on the Mandrill's Bardolphian nose, and the young of the Indian Paddy-bird (*Ardeola grayi*), a very near relative of the Squacco Heron of our British list, display among their tufts of long hairy-looking down a skin of as lively a green as any monkey can show in uncovered portions.

It may happen that young birds are far prettier than their parents, as in the case of the charmingly striped and red-capped young Grebes; in this case they remind one of reptiles, in which the young are generally very much more beautifully and distinctly marked than the old, a contrast which is especially marked in the case of crocodiles and tortoises, which are quite handsome when young, though so particularly dull when adult; and every naturalist must have noticed the pretty silver-and-black young of the plain-coloured slow-worm (*Anguis fragilis*), and the rich sharp tints of young snakes.

According to their reptilian descent, young birds must at first have been active and variegated, and tended to degenerate into uniform down or even nakedness, as they departed further from the ancestral type. The flying, independent young of the Mound-builders, hatched as they are without incubation, ought to be primitive, but they are said to have a suit of down which they cast in the shell, and at any rate they are not striped, a fact which militates against the utility of striping for protection, since they particularly ought to need it, not having any parental care exercised on their behalf, but shifting for themselves from the first

like young reptiles. Also, if striping is so protective, why are striped small animals, although not absolute rarities, so infinitely in a minority compared to the plain brown ones? And why are the pestiferous skunks and zorillas, armed with their fetid secretions, striped like the young Emus and the *Cereopsis* goslings?

The fact is, we shall not know anything certain about the meaning of colouring in relation to protection until our airmen have a chance to take to animal observation, and give us the real bird's-eye view, since some of the worst enemies of all small life must be the birds of prey, which are common in all countries where man has not killed them off to protect his poultry. Beasts and reptiles, of course, do their share of destruction, but the former mostly hunt by scent, and the latter depend much on seeing their prey move, when no colour is of any use.

Although they present such great diversity in the habits and care of their young, as opposed to reptiles in which these are always active and independent, birds, as every one knows, are as uniform in their production of young as in their possession of plumage, since they all lay eggs, and eggs with a hard shell at that, unlike the parchment-coated eggs of most reptiles. But they greatly differ from reptiles in the great diversity of the colour of these eggs, which is of course the reason for the great popularity of birds'-egg-collecting.

Nevertheless, many groups have kept up the

reptilian custom of laying plain white eggs—or at all events very faintly tinted ones. Penguins, Grebes, Pigeons, Owls, Woodpeckers, Barbets, Toucans, Bee-eaters, Rollers, Swifts, Hornbills, Kingfishers, and Humming-birds all lay white eggs, and although most of these lay their eggs in holes, a great number do not, notably all the Humming-birds and nearly all the Pigeons, our common Blue-rock and the Stock-Dove being quite exceptional in the family in their habit of breeding under cover. The eggs of the Duck tribe also are always light-coloured and unspotted if not actually white, though in this case it must be admitted that the birds always cover them when leaving the nest, as do some of the Game-birds, like the Partridge. On the whole it would seem that birds which lay white eggs simply do so because they are physically incapable of laying eggs of any other colour.

With regard to the numerous spotted eggs, it may be freely admitted that when laid on the bare ground, as by Plovers, they are often really hard to find, and that here protective resemblance probably does come into play; but in the case of the often bright-coloured and beautifully-variegated eggs of passerine birds, generally deposited in open nests in trees and bushes, the colour does not seem to be of any great importance, the great point being that the nest should be concealed. If such eggs were coloured to assimilate to the foliage, we might expect some green ones, but in practice there are no truly leaf-green eggs except those of

the Cassowaries, which are just like big unripe plums, and are of course laid on the ground. And as a matter of fact, eggs of any sort are practically never of a pure colour, either in ground or markings; blue-greens, green-blues, brown-reds, and yellow-buffs are the usual tints, but no egg is azure-blue, scarlet-red, or gamboge-yellow, or even magenta or violet.

The most richly coloured eggs are those of the Tinamous (*Tinamidæ*), which have a glaze like china and are self-coloured, exhibiting such tints as sea-green and plum-purple, though they soon fade when blown. The Tinamous themselves are one of the plainest-coloured families of birds in existence, not one species having any bright or conspicuous marking, and only a few even such little decorations as a red bill or yellow legs; and it will be noticed that taking the class of birds as a whole, a beautiful bird never lays a beautiful egg, and *vice versâ*. "The music of the moon sleeps in the plain eggs of the nightingale," says the poet, and the glories of the Peacock's rainbow train and the Golden Pheasant's glowing crest and blood-red breast are packed into eggs of a simple cream-colour, while in the same family the sombre Grouse and Quail lay quite richly mottled eggs.

One of the most curious coincidences among birds is to be found in the markings of the eggs of many birds of prey, which are just like dried blood, foreshadowing the little murderers which will break through their shells; a believer in ma-

ternal impressions would tell us that this is just what one might expect, but the white eggs of the equally sanguinary Owls would confute him.

But the existence of such meaningless coincidences should make us careful in assigning a survival value to every modification of form and colour in either bird or egg; the subconical shape of the Guillemot's egg, for instance, certainly renders it less likely to roll off the ledge on which it is laid, but then one parent bird or the other is always on it, and the peg-top shape of the eggs of Plovers and shore-birds, although it facilitates packing in the cross-shaped arrangement, points all inwards, which the sitting bird affects for them, may be merely incidental and not specially evolved.

Sometimes there seems to be no reason whatever for the peculiarities of an egg; why, for instance, should the curious Pink-headed Duck of India (*Rhodonessa caryophyllacea*) lay, in an ordinary Duck-nest, eggs which in colour, gloss, and roundness remind one of a set of billiard-balls? Then as to markings and tint, no reason has been given why the Guillemot should lay eggs so extraordinarily variable in these respects, or why birds which lay coloured or variegated eggs should, generally speaking, exhibit so much difference in their output, as compared with the uniformity of their plumage.

Broadly speaking, one may expect in any species laying a variegated egg specimens lightly and heavily spotted, and others with fairly evenly distributed markings contrasting with some in

which the colouring tends to concentrate in a belt or cap, almost invariably at the large end—phenomena which are well exhibited in the common Sparrow. No other bird is anything like so variable in its egg-coloration as the Guillemots, but some are very far from being even ordinarily true to type, as the Red-backed Shrike with its olive and red types, some Indian Warblers with their blues and reds, and some of the African Weavers with their self-blues, spotted blues, and whites.

Individual birds, however, tend to reproduce the same type of egg; there is an historical instance of a Guillemot which laid on a particular rock-shelf an egg of the rare and valuable red variety which was duly taken for fifteen years on end—though of course this might have been the produce of another bird with the same peculiarity. Yet on the other hand, all the eggs in a laying may not match; the Tree-Sparrow is notorious for having one differently marked egg in every set, and the Golden Eagle commonly lays one variegated egg and one plain one. It is said, also, that in the case of birds which lay richly coloured eggs, the coloration varies as the bird advances in years, which is, after all, rather what one might expect.

The colour is in any case laid on almost like paint, and will smear if the egg be washed when new-laid; while in the case of the eggs of many groups—Shore-birds (*Charadriidæ*), Gulls, Rails, and song-birds especially—it will be noted that there are often two sets of spots, one of which

has been laid on before the shell is complete and so lies deeper and looks fainter, such under-surface spots being grey, lilac, or mauve in colour.

In the eggs of Cormorants and their kin (*Steganopodes*), Grebes, and some of the non-parasitic American Cuckoos (*Crotophaga*, *Guira*) there is a chalky layer external to the real shell, which is often blue, and shows here and there. In the case of the Cuckoo *Guira*, the "White Ani," the effect is exceedingly pretty, the rich blue shell being plentifully flecked, but not obscured, by the chalky secretion. Grebes' eggs, by being covered by the owners with some of the sodden weed of which the nest is made, soon get stained and are generally seen as buff or brown objects, though the proper and original colour is white; Ducks' eggs are naturally greasy on the surface. The egg of the Fulmar is distinguishable by the nose, having the same strong smell as characterizes every part of its producer, even to one feather.

The surface of birds' eggs generally varies a good deal, from a rough one like unglazed porcelain to the glazed type best shown in the Tinamous' eggs; but Kingfishers and Owls also lay very glossy eggs, and Ostriches' eggs are both glossy and pitted. The shell gets duller and more brittle as the eggs are sat upon in the case of birds generally.

The number of the sitting varies in a very interesting way; in quite a number of birds it is at the minimum, the egg being single. This is the case with Petrels and Albatrosses, the Gannets, the

American Vultures, the Lämmergeier, the Sun-Bittern, the White Noddy (*Gygis*), the Crab-Plover (*Dromas ardeola*), and many Auks, Penguins, Humming-birds, and Pigeons. Most Pigeons and Humming-birds, however, lay two eggs, as do some of the diving sea-fowl just mentioned.

Four is the ordinary number with the shore-birds—Plovers, Sandpipers, and so forth—and it is only among these that a larger set than one or two is constant; as a general rule when twins are exceeded, "several" is the only numerical expression which can be used to describe the hatch. Birds which do not lay two or four eggs seem, however, often to think that there is luck in odd numbers, for three, five, and seven are frequent numbers.

There is a widespread tendency, as that very acute observer, Mr. E. C. Stuart Baker, has pointed out, to over-rate the number of eggs laid by the Game-birds and Ducks; these are really not so much more prolific than the birds nursing helpless young in nests as is supposed, at any rate in the East. The wild Hen oftener lays six eggs than a dozen, and this will be a reasonable brood for many Ducks; the Australian Musk-Duck (*Biziura lobata*) only lays three eggs. It would appear, however, that in Europe most birds, Passerines included, are more prolific than in the Tropics.

The eggs of birds which have active young are credited with being bigger than those from which passive nestlings are excluded, as well as more

numerous; and certainly the largest eggs proportionately to the parent come from species with this habit. The Guillemot, for instance, whose young is as active as existence on a narrow shelf of rock admits, lays an enormous egg, and this is surpassed by the Kiwi, whose egg is so large that it is difficult to see where the bird's internal organs go while it is being carried, and the male bird, which alone incubates, cannot cover it properly, but has to lie across it. The Jack-Snipe, too, accomplishes something like a record in laying four eggs so big that they average over the inch in their widest diameter, while the bird is not bigger than a Lark.

The Raven, on the other hand, is remarkable, even among nestling-fosterers, for the small size of its eggs, which are hardly bigger than those of the Carrion Crow, a bird hardly more than half its size and of similar general habits. The Wren, true to its original and self-assertive character, lays a large sitting of relatively large eggs for its size. It will be noted, however, that very small birds do not lay the tiny eggs one might expect; those of Humming-birds, for instance, though among them may naturally be found the smallest of all eggs, are not proportionately so minute as one might have supposed.

There is evidently a limit to the smallness of eggs; an experienced poultry-fancier told me not long ago that this was the obstacle which faced the bantam-breeder, for whenever an exceptionally tiny pullet was reared, she was certain to succumb

sooner or later at the attempted laying of her first egg, the egg not being reduced proportionately to the size of the hen. Something of this sort may have operated to prevent Humming-birds becoming as small as blue-bottles—the actually smallest species, *Calypte helenæ* of Cuba, being just about as big as a queen humble-bee, though I doubt if it is as light as *Mellisuga minima*, which used, as its name implies, to be considered the smallest of birds.

The Storm-Petrel, smallest of web-footed fowl, certainly lays a very large egg for its size, although the young is helpless; it is not larger than a Swallow, while its egg measures an inch in length, and this is not purely a matter of disproportion to reduced size, for Petrels generally lay a large egg.

It is worth noticing that it is among birds which lay a single egg that the most sensationally numerous species are found; the Passenger Pigeon of America (*Ectopistes migratorius*), so recently extinct, whose columns used to take hours to pass a given spot, was one of the Pigeons which lay but one egg. The Puffin is supposed by some to be the most numerous bird in Europe, and some of its brother Auks, like the Guillemot, are also inordinately numerous; the extinct Great Auk was wonderfully abundant in its day, as is the common Gannet still for a bird of its size, while according to Darwin, the Fulmar Petrel is said to be the most numerous bird in the world. This is very doubtful, but he might have been thinking of another Petrel, the Mutton-bird (*Puffinus brevicauda*), which has been seen in enor-

mous masses in the South Pacific, quite equalling the old-time flocks of Passenger Pigeons.

At any rate, such facts as these look as if one-egg-laying were a good habit for survival; but at the same time we must remember that the birds above quoted are conspicuous for living or at any rate breeding, in masses, thus giving a false impression of their numbers as compared to more scattered species; that most of them draw their living from the hospitable storehouse of the sea, and that two of them did not stand long against human destructiveness at any rate, and might not have withstood the invasion of any other carnivore.

Moreover, some of the single-egg-layers are scarce birds; the Condor and Lämmergeier are not nearly so common as the smaller Vultures—I only saw two of the latter during all my residence in India; and the large Hornbills, which lay only one egg, are always rare where the smaller and more prolific kinds are common. There may be in some cases good reason why only one egg should be laid, as will appear in the consideration of some curious incubation and nursing habits, but it is a quite possible consideration that birds which lay only one egg are on the decline as species through infertility, since one egg a year—and sometimes even one in two years, as is said to be the case with some of the great Vultures—is a perilously low output, and the sea-birds are liable to numerous accidents.

And as to actual numbers, it is highly probable that such birds as the Quail and Skylark, which are

common almost all across the Old World, are really more abundant than any bird which ever nested in close-packed colonies and flew in cloud-like flocks.

The fertility of birds laying several eggs appears to increase with age; the Swan, for instance, lays twice as many eggs when mature as she usually does when starting laying in her second year. It is true that domestic Hens decline in fertility in a year or two; but then they are expected to lay in one year twenty times as many as their wild ancestress does. Tame Ducks are more fertile; with an equally exaggerated egg-production, they lay a paying amount of eggs—at any rate in the case of the prolific Indian Runner breed—for twice as many years as a hen.

Yet the Muscovy Duck, the Turkey, and the Goose have not had their fertility increased as a rule above that of wild birds. These always have eggs in reserve; even if the set be only one or two, others will replace it at least once in case of accident, and birds which lay several eggs will under artificial stimulation produce numbers at times as great as an inferior domestic Hen. An unfeeling naturalist once made a Wryneck lay forty eggs in a season by removing them as fast as laid, a piece of brutality which very probably ended in sterilizing its subject, as an extreme output in one year is likely to reduce subsequent prolificacy, as one would expect. In a case I heard of in which a hen Silver Pheasant laid seventy eggs in one season,

I was afterwards told that she had laid none at all the next.

What may be called voluntary overlaying is rather apt, however, to occur in captive birds; the Californian Quail (*Lophortyx californicus*) is particularly liable to it. It may even occur in Nature; thus, a specimen of the Indian Nukta or Comb-Duck (*Sarcidiornis melanonota*) has been captured on a regular deposit of eggs, tier after tier, amounting to forty in number; and as she was very emaciated, and one of the eggs was very small, presumably her last, she had no doubt laid the lot.

Such cases as these, and exceptional Turkey hens that lay a hundred eggs, show us how our high-laying races of Fowls and Ducks have been originated; they began a long time ago, since Aristotle speaks of every-day layers. Birds may deposit their batch of eggs at the rate of one egg a day, or lay at intervals of two or more days; the rule is not constant for the same group, since the Pigeon deposits her second egg two days after laying her first, and the Collared Dove lays her pair on consecutive days. With hens and Turkeys, too, every-day or intermittent laying varies individually.

Most birds, although keeping about the nest, do not begin to sit till they have got the full number; the rule appears to be universal among those which have active young, since their broods all come off at once, but birds may make a mistake or get impatient, and go off with a partial brood, leaving

tardy or insufficiently incubated hatchlings to perish in the shell.

Many birds which have nestling young, however, evidently begin to sit at once, since nestlings of very different ages may be found in the same nest; this is notoriously the case with some Owls—such as the Barn-Owl—and Hawks, and it is noticeable with Budgerigars, at any rate in captivity. In such a case, the youngest member of the brood may be callow and blind, while the eldest is feathered and almost ready to fly; and in such cases it is curious that the youngest can survive at all, especially in the case of birds of prey, where it must offer considerable temptation to the appetites of its nest-fellows.

Indeed, a case has been recorded ("Notes on Cage-birds," ed. Greene, 2nd series) in which a brood of young Barn-Owls when shut up in a room with a supply of meat nevertheless killed and ate the Benjamin of the family, and a brood of Canaries I reared myself all hatched out on different days, the five eggs having been laid, as usual with such birds, consecutively, with the result that the youngest, which was a little overdue and helped out by me with a pin, was fatally crushed, with the next youngest, by the other three. To avoid such occurrences, it is the custom of many canary-fanciers to take away the eggs as fast as they are laid, replacing them with a nest-egg, and putting them back when the complement is complete; but this is not always done, and the wild small birds

generally get on successfully with their broods, no doubt not being tempted to sit so closely as Canaries, owing to the need of seeking food for themselves.

I noticed with the Dabchicks which bred on the Indian Museum pond that they seemed to attach no value whatever to their eggs till they had the full set; the first laid were allowed to lie, conspicuous as they were by their whiteness, uncovered in the nest, which was only among the low-growing *kalmi* or water-convolvulus or among thin reeds. I can only conclude that the eggs escaped the attention of the numerous House-Crows simply by the dread these worthies had of risking their precious persons in the attempt to pick up an object lying practically on the surface of the water, for I found they did not dare to pick up bread thrown into the pond, although the same species of Crow down by the Hooghly picked food from the water as a matter of course.

When the Dabchicks began incubating, however, they were careful enough, and always covered the eggs before leaving them, after the usual manner of Grebes; curiously enough, however, though they kept the nest piled up while they were brooding the young on it, they did not raise it when they had eggs and these were menaced by a flood, and lost two sittings in this way in consequence. Under similar circumstances a Swan, as is well known, will raise her nest, but then she is always ready to do this, if material is within reach of her bill.

I noticed that with these Dabchicks incubation

was very largely left to the sun, or to the heat generated by the decaying weed in which the eggs lay, for they were often both off the nest at all and any times of the day; and this habit of hatching otherwise than by constant incubation has been often noticed. The Black-back Courser (*Pluvianus ægyptius*) of the African river-banks buries its eggs in the sand and damps them to prevent them getting too hot; Sand-Grouse on the plains of India have been found sitting on the eggs not to warm them but to keep them cool, since under the blazing sun they actually began to cook if the birds were scared off for a little time; and the Ostrich has quite a reputation for letting the sun hatch its eggs, though this only happens in the more tropical part of its range—in South Africa it sits like any other bird.

Ordinary passerine birds may even in exceptional circumstances make use of the sun as an incubating agent; in Hume's "Nests and Eggs of Indian Birds" there is a record of a pair of House-Mynahs (*Acridotheres tristis*) which built in a hole under the edge of a roof fully exposed to the Indian hot-weather sun, with the result that both of the pair were always to be seen off the nest, the cock singing vociferously and thrashing casual Crows after the usual manner of his kind.

There is a whole family of birds, allied to the Game-birds, which carry matters further, and never sit on their eggs under any circumstances, these being the Megapodes or Mound-builders, referred

to above as producing young which are able to shift for themselves as soon as hatched. Owing to one of the largest of them, the Australian Brush-Turkey (*Catheturus lathami*), being frequently imported, their habits in at least one case are fairly well known, and have besides been studied in their native haunts in the case of several other species. Generally speaking, they live in Australia and New Guinea, but one, the Maleo (*Megacephalon maleo*), is found in Celebes, and the birds of the typical genus *Megapodius*, which are more like large dull Partridges than anything else, are widely spread from the Nicobars to well out in the Pacific Islands —Ninafou and Samoa. All lay very large eggs for their size, so that here at any rate large size of egg corresponds with high development of the young when hatched, and make up their natural incubators with their powerful feet, in which the hind toe is well developed and low set, although they do not perch more than the typical Game-birds.

Their claws are often very long and strong, and they present the peculiarity, only found elsewhere among birds in the Cuckoos, of having the second and third toes, *i.e.* the inner and middle front ones, joined by a short web at the base, whereas this web, where it exists in other birds, is either between the outer and middle toes—third and fourth—as in the Herons, or connects all the toes, as in typical Game-birds. I mention this point because it is commonly supposed that small points not obviously connected with habits, and hence of value in classi-

fication, are only to be discovered in bird anatomy, whereas they occur externally also.

The Mound-birds always lay several eggs, and always bury them; but their procedure in this respect varies: the Maleo simply inters them in beaches of black volcanic sand, and is supposed to deposit them in the hatching-holes at intervals of a fortnight. The Brush-Turkey hens, however, lay every two days, and the species of this family generally scratch up mounds of earth, sand, and dead vegetable matter, that of the Brush-Turkey having a circumference of three dozen yards, with a height of a little over two feet.

In this species, as observed in captivity at all events, the male does all the work of preparing the mound and looking after the eggs, when laid and buried, driving the hen or hens off as soon as they have laid, and then covering them deeply or thinly as occasion seems to demand. As many as twelve to fifteen eggs may be laid by one of these birds, but sometimes several pairs may share a mound, though this seems not to be the case with the typical *Megapodii*, which also use more sand and less vegetable matter than the Brush-Turkey. The latter bird breeds in the preserves of the Duke of Bedford, and did so in the Zoo in a quite small enclosure during the Bartlett period, and of late years when Mr. Bertling was head-keeper.

When hatched, the young scratch their way out or are dug out by the old birds; and not only are they hardy when hatched, but their development

in the egg appears to be able to proceed in some cases without any extraneous heat, such as is certainly generated in the Brush-Turkey's mound by the decaying vegetable matter. More than a dozen years ago, some eggs of the Nicobar Megapode were taken from a mound in the islands and put on board the Government ship *Elphinstone*. Here they were allowed to lie about on deck in a bucket, and when the ship got up to the British settlement in the Andamans they were put away in a cupboard; nevertheless some chicks at all events hatched out and were reared, and I saw these at the Calcutta Zoo, where they were sent when full grown. It would appear, however, that the temperature in these Megapodes' mounds is not high, the part where the eggs are buried being if anything cool to the touch.

The Mound-birds are a group with a long incubation-period, the Brush-Turkey, a bird of the common Fowl's size, taking six weeks; the incubation-period of birds being a group-character or minor habit, differing in length according to the family to which the bird belongs, but, in the case of birds of the same family, being generally in proportion to the size of the species, large birds generally taking a longer time than small ones.

Thus, among our familiar tame birds, the Fowl, as most people know, takes three weeks, the Turkey and Peacock a month; the common Duck takes a month, the large Muscovy Duck five weeks, the Goose four, the Swan six. Both the Duck and

Fowl belong to long-period families; among the short-period birds we have in domestication, the Pigeon takes seventeen and the Collared Dove fifteen days, and the Canary a fortnight, both Pigeons and Passerines having short incubation periods.

Owing to this family limitation of periods, we get some very curious contrasts; such big birds as the Crowned Pigeon (*Goura coronata*) and the Raven only taking three weeks, while the tiny Painted Quail (*Excalfactoria sinensis*), no bigger than a Sparrow, and the Teal, not larger than a Pigeon, take as long, and the Storm-Petrel even five weeks, in spite of its small size.

It will be seen that however small the bird, the reduction of its incubation-period does not keep pace with the size; nor does the increase in the case of large species. Some of the smallest Finches only sit for eleven days, and even the Humming-birds are only credited with a day less; the longest incubation period is that of the Emu, in which the devoted male sits for nine weeks, longer than the Ostrich, with its six or seven, but this bird belongs to a distinct family, all the clans of flightless giants being very well differentiated anatomically, and evidently representing independent degenerations from flying ancestors, though of an early type.

In a few cases the smaller bird in the same family may take a longer time than a larger; thus Partridges and Gold Pheasants take longer to hatch than Fowl chicks. The case of the common Pheasant,

which also takes longer, need not be mentioned, because the wild fowl is not so large as this bird, and curiously enough increase of size in domestication, however great, does not seem to affect the incubation period to any noticeable extent.

There does not seem to be any general correlation between the activity of the chick and the period of incubation; the young of the Hemipodes or Button-Quails, birds about the size of Quails proper, hatch in only twelve days, although downy and active, while the helpless nestlings of the Budgerigar, an even smaller bird, take nearly three weeks, Parrots being a long-period group; and the nestlings of birds of prey require a long time to hatch, the largest, the Condor, even requiring six weeks. On the whole there is a tendency for water-fowl to take a longer time than land-birds, no aquatic groups having a really short period, though none take so long as some of the great runners. The period of incubation does not vary more than a day or two unless over a month, when the variation may be a matter of several days, as in the case of the Swan and Ostrich.

As the temperatures of different groups vary, incubation may be hastened artificially in some cases; when Mandarin Ducks were first bred at the Zoo, now nearly seventy years ago, it was noticed that those of their eggs which were put under hens hatched two days earlier than those which the Ducks themselves were allowed to sit upon. M. Rogeron, in discussing Hens as foster-

parents for these and other fancy ducklings, condemns some Hens as altogether too hot, so that the eggs entrusted to them come out so much too soon that the young are weakly and unsettled, and die off through sheer inability to live.

The frequency with which eggs of birds have been placed in domestic conditions under other individuals or species has brought out conspicuously the great difference in patience in sitting birds; Hens and Turkeys will often sit out two periods if compelled or even allowed, while Pigeons refuse to incubate more than a day or two over their limit, and I do not remember any case of waterfowl exceeding their time. However, the Hooded Crow, although one would have thought this cunning bird not easily duped, will, according to Graham in his "Birds of Iona and Mull," sit so far over her time when her eggs have been removed, boiled, and replaced by boys, that she is easily captured through the weakness and exhaustion caused by this unnaturally protracted incubation.

Evidently the Crows are not immune from the extreme mental upset which occurs during the incubation period; poultry-keepers well know that the most effectual cure for a broody Hen is to place her in a coop with barred floor and supported on legs, for some Hens will sit almost indefinitely, not only on any object they can imagine to be an egg, but even on an empty nest. By making the bird continually perch, however, the delusion becomes impossible of maintenance, especially if

her mind is distracted by seeing the other Fowls enjoying life outside her prison.

The domestic Hen is not alone in being able to solace her mind with a substitute for an egg; Hume in his "Nests and Eggs of Indian Birds" gives an amusing account of a Kite which sat upon a pill-box until rain wrecked this treasure; and a pair of Cranes nesting in captivity, but unable to produce eggs, fished up a couple of pieces of brick from the bottom of their pond and made believe they were eggs. Facts like these are of importance when we consider the ease with which birds, even of intelligent kinds, may be duped into caring for eggs of parasitic species.

There is, as a matter of fact, a physical as well as mental change in a sitting bird; the abdomen becomes inflamed and bare, constituting the "hatching spot," and no doubt it is irritation here, not a self-sacrificing feeling, which makes Ducks pull off the down of their breasts which they then use as a nest-lining. In the hole-building species indeed this practically constitutes all the nest, but in tropical Ducks, although these often, in fact perhaps usually, breed in holes of trees, this lining is scanty, and may be wanting altogether.

The commercial importance of the female Eider's down—the drake contributes none, apparently even in an emergency—is well known, but a physiological fact about this bird which is less familiar is its power of enduring a fast while sitting, at any rate in captivity, Mr. St. Quintin, one of the few

people who have bred the species, recording that a bird of his seemed never to leave the nest during the whole time of sitting, so that chickweed growing around grew all over its back.

In any case birds need little food while sitting, and their excreta are concentrated in a remarkable way; any one who keeps Fowls or Pigeons has noticed that when a sitting hen leaves the nest she voids a large mass all at once, and the scent appears herein to be concentrated, thus explaining the fact that the body-scent of a sitting game-bird, so perceptible at other times to the nose of a questing beast of prey, becomes suppressed, being as it were driven inwards.

In spite of the wearisome nature of the task as it appears to us, it is evident that birds must experience great satisfaction in the action of incubation, as also in the more toilsome but seemingly more interesting process of rearing the young, since they are so irresistibly impelled to it that in many cases it is repeated several times during the year; in fact, some tame birds, such as fancy Pigeons, Canaries, and Budgerigars, would endanger their health and produce weakly offspring by continually breeding—in the case of the last even in out-door aviaries in mid-winter—if their owners did not by removing nesting facilities, or even by separating the sexes, put a stop to propagation after a reasonable number of broods had been raised.

Birds which have active young are less philo-

progenitively inclined, the rearing of one brood satisfying as a rule both wild and domestic species of this character for the year, even the pampered park Mallard not breeding in autumn, though they pair; and among the birds which have helpless young, or at any rate young which have to be fed, the least fertile, *i.e.* those which lay but one egg at a time, are also the least apt to want to repeat the process. The diving rock-birds which throng our cliffs, for instance, depart to sea quite content with their single chick.

Pigeons, however, are quite willing and anxious to repeat their task of rearing twins as often as occasion allows, that is to say, as long as they can get plenty of food. I have seen Wood-Pigeons in Regent's Park, where conditions are exceptionally favourable, pairing at Christmas in very cold weather, and in India nests of the commonest species of Turtle-Doves are to be found practically all the year round, so that these birds apparently are always ready to breed, except, no doubt, when moulting, at which time the most enthusiastic nesters have perforce to postpone operations.

Ordinary passerine birds, also, frequently rear two or even more broods in a season, so that even when their sittings are individually less in number than those of birds with active chicks, their total output for the year is larger. There are also certain individual species which have a special bent for procreation, and will commence nesting on less provocation, if I may so express it, than any others;

such are the birds that are commended as "good breeders" by aviarists, and in wild nature in this country we may notice that it is the Song-Thrush and the Robin which generally contribute the "early bird's nest" newspaper records, leaving even such prolific birds as the Blackbird and the Sparrow far behind in the race for actual priority of commencement, though these may equal the output before the year is over.

Generally speaking, however, it may be said that wild birds nest only once a year, and some of the large birds of prey are said only to do so in alternate years.

CHAPTER VI

Propagation (*continued*)—Nest-making not purely a bird-habit —Eggs laid without nests—Types of nests—Parasitic nesting —Parasitic layers, like Cuckoos and Cow-birds—Degrees of development of parasitic instinct.

Birds are not alone in incubating their eggs any more than in laying eggs at all; for pythons among snakes incubate their eggs, coiling round them and undergoing a rise of temperature, while the Echidna of Australia, one of the only two egg-laying mammalian types—the other oviparous beast being the Duck-billed Platypus—carries her single egg in a temporarily formed pouch. The two eggs of the Platypus are laid in her burrow.

Neither is nest-making confined to birds, for, putting aside the extraordinary structure made by many insects, we have nest-makers among the vertebrates in the persons of many fish—including our little stickleback—in some tropical frogs, and in numerous beasts from the gorilla to the harvest-mouse. These points are worth mentioning, because some naturalists theorize about birds' nests as if nest-making were a special bird habit, whereas for all we know the particular reptile which preceded the first definite bird may have been a nest-builder already.

Be that as it may, many existing birds make nests no more elaborate than those of some reptiles; the practice of the Mound-builders in burying their eggs is much the same as that followed by crocodiles and tortoises, and the African or common crocodile (*Crocodilus niloticus*) has been observed in Madagascar sleeping on her deposit of eggs, and is believed to keep on hand to dig up the young when they hatch, and take them off. This is very like the action of the Mound-birds—and also of those fish which guard the nest, aerate the eggs, and protect the young—and as the crocodiles are the nearest related of present-day reptiles to birds, as their anatomy and bird-like eggs testify, it is tempting to regard the Megapodes as the most primitive of nesters, especially considering the advanced state of their young on exclusion from the egg. If, however, a previous coat of down is shed in the shell, they are not so primitive as they look, probably, but have gone back to the simple life.

In any case, there are birds which do far less in the way of nesting. The two giant Penguins, the King (*Aptenodytes pennanti*) and the Emperor (*A. forsteri*), for instance, do not put their single egg down anywhere, but keep it pressed up against the skin of the abdomen, which bulges over it, and supported by the feet, which are kept close together, and so incubate standing. The bird thus cannot walk freely, but it can shuffle about awkwardly, and thus move its egg from place to place if necessary. The habit seems reasonable enough in the Emperor,

which breeds on the Antarctic ice at mid-winter, of all seasons, and so needs to protect the egg and chick from cold before everything, but in the King, which does not reach the Antarctic circle at any time, and breeds on land, the habit seems less significant.

It is curious, too, that as the great danger of the infant Emperor's life is the scrimmage for its possession which results when it is seen, all childless Emperors desiring to foster it, the only break in the whiteness of its down is the black skull-cap, making its little head conspicuous against the white belly of the parent, and thus proclaiming the possession of the treasure. The young King is quite different, being dark brown all over, though the parents are so much alike. It is easy to see why these birds only lay a single egg, and also why this is the case with the Guillemots and Razorbill, and with the White Noddies, which have the next simplest nidification, simply laying the egg on an unprepared surface and keeping constantly on it.

The nesting-places of the Auks above mentioned are high cliff-ledges, often even sloping seawards, so that the egg, in spite of its sub-conical shape, would roll off if one or other of the birds did not constantly sit on it, which they do facing the rock, no doubt so as to minimize the chance of dragging the egg off with them when leaving it.

But that of the tropical White Noddies, renowned for their spirit-like appearance and uncanny tameness, is not only a point of a coral reef, but

equally or more often the branch of a tree or the broad leaf of a palm; any slight depression is chosen if possible, but often even this is dispensed with. The bird covers and leaves its egg very gingerly, and is credited with such foresight as, when laying on a leaf, so to time the hatching that if the leaf withers and droops, by the time the slope has become too dangerous, the egg will have hatched. The chick has great powers of holding on, having particularly long middle claws; the hind toe is also of normal size, not rudimentary as in other Terns, and the feet are only half-webbed. As the plumage is also scanty for a water-bird, and the bird nests inland and even eats fruit, we have here perhaps a primitive Gull-type.

Other birds that simply lay their eggs on the spot chosen without any nest are the Nightjars proper, though the Owlet-Nightjars lay in holes in trees, and the Frog-mouths, members of the same family as the last (*Podargidæ*) make nests, of sticks in the case of the well-known Australian More-pork (*Podargus cuvieri*) and of a curious pad of down on a branch in the case of the Eared Frog-mouths (*Batrachostomus*).

Simple deposition of the eggs on the ground is unusual in birds of the type to which Nightjars belong, but is not uncommon among running or swimming birds; Divers, Sand-Grouse, Bustards, and many of the Game-birds, Plovers and Terns making either no nest at all, a mere "scrape," or a very meagre collection of bents, leaves, etc. The habit

varies, for in the same ternery some nests will have practically no furnishing, and others be fairly well provided.

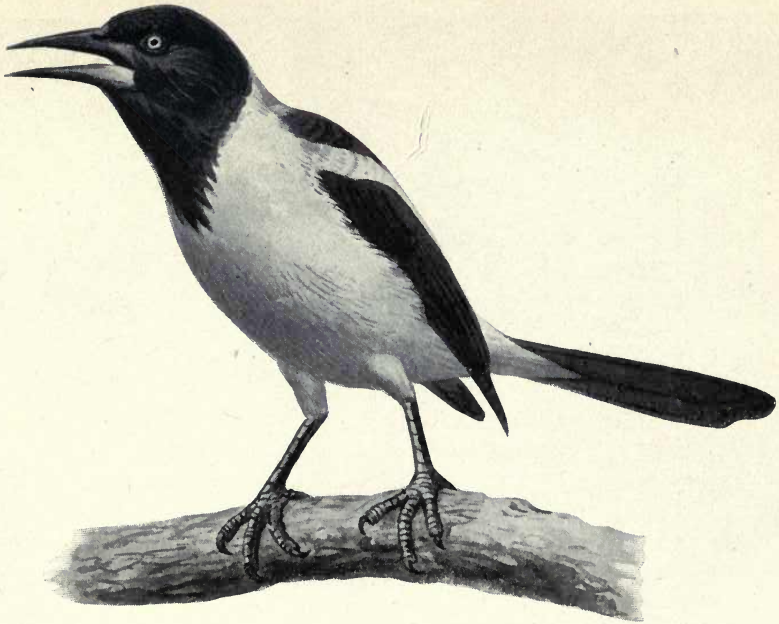
Some birds, such as the Ringed Plover when breeding inland, and the Adélie Penguin of the Antarctic (*Pygoscelis adeliæ*) build nests of stones, which in the latter case are indeed the only available material; and the male Penguin "proposes" by offering the hen a pebble. In the case of this Penguin the nesting-site appears to belong to the hen, which arrives first and takes possession; but in some cases at all events nesting-site property is vested in the male bird, which brings his hen to his chosen haunt, or arrives there first and guards it for her, when the two have been separated on migration, as male birds generally arrive first.

The next simplest plan to laying the eggs on the ground is laying them in a hole therein, or in a rock or tree, without any nest; this is a common practice, especially characteristic of Parrots, Owls, and some other non-passerine perching birds, such as Toucans and Hornbills. Holes often have to be cleaned out, and so this practice passes naturally into the widely-spread custom of the bird excavating its burrow itself; in fact, the two habits are hard to separate, as often the same species will occupy a hole if it is there already, or make one for itself if such accommodation is wanting.

Burrowing is found in scattered members of many groups, such as the Burrowing Owl (*Speotyto cunicularia*) of America, the Sand-Martin and some

CONCAVE-CASQUED HORNBILL.

This Asiatic species is shown with the nesting female characteristically walled up in a hole in a tree.



BRAZILIAN HANG-NEST.

This South American bird bears a close superficial resemblance to some of the black-headed Orioles of the Old World.

other Swallows, the Minera (*Geositta cunicularia*), a South American passerine bird, some Penguins, and the Puffin amongst the Auks; but it is especially characteristic of birds which sally forth for their prey from a perch and return to it, using their feet but little, such as Kingfishers, Bee-eaters, Todies, and Motmots, and of Petrels among the sea-birds. Bee-eaters are most inveterate burrowers, forming regular warrens and even sometimes burrowing into level ground as Petrels do, most bird-burrowers generally liking a bank for their tunnels.

It has been said that animals which do not get their living by burrowing do not show any special adaptation for it, and the Sand-Martin is a case in point; but the Kingfishers and other burrowing perchers, where burrowing is a family habit, are noteworthy for the union of their toes, forming a flat broad sole, which must be of some use in throwing out the sand. It is true, however, that Hornbills have similar feet, although they do not burrow, but nest in holes in trees as said above; but they are near akin to the other joined-toed families.

Kingfishers when starting a burrow have been seen to dart at the bank and dislodge the earth by this charge, the pair relieving each other and repeating the action until a big enough depression was made to allow them to get to work with their feet as well. Parrots with their gnawing beaks and powerful short legs are better adapted for burrowing than any other birds, and some do thus nest in banks, such as the Patagonian Conure (*Cyano-*

lyseus patagonus), one of the few Parrots living in temperate and cold climates, as a usual thing, and the well-known Lemon-crested and Rose-breasted Cockatoos occasionally.

The strangest of burrowers is, however, the remarkable pied Crab-Plover (*Dromas ardeola*) of the shores of Eastern seas, for one would never expect a long-legged wader like this to burrow; yet it does so, and lays at the end of its bow-shaped tunnel one large white egg, having in fact the nesting-habits of a Petrel. This bird is a primitive type, being curiously intermediate in appearance between a Plover and a Gull, with half-webbed feet provided with a well-developed hind toe, unlike the families to which it is most nearly related. As to what long-legged birds can do in the way of digging, I never realized this till I saw the cock Rhea making his "scrape," which he does in a crouching position, and nevertheless thus uses his powerful limbs to great effect.

Among the Woodpeckers, the Ground Woodpecker of the Cape (*Geocolaptes olivaceus*) burrows in banks, but, as every naturalist knows, these birds generally cut out their nesting-holes in trees; this is all part of the day's work for the Woodpecker, which is a carpenter by trade, but the Barbets do it too, although not pecking wood otherwise, and curiously enough have a fancy for beginning the hole from the underside of the bough, so that they have to commence operations upside down.

Where burrowing or tree-hole-cutting is a family

habit, no nest is made by the bird, the eggs being laid on the floor of the hole; in fact, such birds throw out all they find inside a hole, and the Starling greatly annoys and even dispossesses the much larger and more powerful Green Woodpecker by carrying nesting-stuff into his borings. When, however, the hole-builder, burrower or merely appropriator, is a member of a family whose general custom is to nest outside, something like the normal nest of the family, though often a very slovenly one, is made, as by the Sand-Martin, Jackdaw, Stock-Dove, and Sheldrake, and the many kinds of Tits.

This points to the hole-building in these cases being a recent habit, but some members of genuine troglodyte families may as an abnormality build a nest; Mr. E. C. Stuart Baker has found the Indian White-breasted Kingfisher (*Halcyon smyrnensis*) doing so, the structure being a domed one of moss. There is some connection between making a domed nest and breeding in holes, for, as every one knows, the House-Sparrow, whose nest is naturally a domed one in a tree, readily takes to nesting in holes, and so do many of the small foreign Finches commonly imported.

In the case of the Tree-Sparrow, the hole-building habit has apparently nearly superseded the tree-nesting one, a nest of this species anywhere but in a hole—of a tree in most places in Europe, or of a building in the Himalayas, Japan, and a few other places—being cited as a notable exception. This is

of interest, because the Tree-Sparrow is in some respects the most advanced species of the true Sparrows, having in both sexes a coloration which is masculine only in its nearest allies, and the widest distribution, for the House-Sparrow, though actually found in more countries, has in many cases been transported deliberately by man, whereas its rival colonizes on its own account.

Nesting with a covering of some sort, found existing or constructed, overhead, is a habit of which birds which possess it are very tenacious, and however intelligent they may be in other ways, such birds seldom venture to nest in the open; of this the Sparrow, Starling, and Sheldrake are conspicuous examples. Nevertheless among birds which make nests as opposed to burrowers, dome-builders are the exception, most constructed nests being open, either mere platforms or piles, such as those of the Woodpigeon and the Moorhen, or advancing to the state of a more or less deep cup, such as is built by most passerine birds.

Such nests with elevated sides or domed roofs may be built by a process of felting, as when made with moss and similar substances, or actually woven with a skill which is at times most admirable. Unfortunately we are not well off in the north for very skilful nest-builders, and the only woven nest of a British-breeding bird is that of the Golden Oriole, a species unfortunately too much persecuted to have other than the rarest chances of exhibiting its skill; the nest is a woven hammock, suspended

in the fork of a bough, and this is the type of nest built by the true Orioles generally.

The Troupials, wrongly called Orioles in America, from their frequently similar yellow-and-black coloration and general habits, build, however, far more wonderful nests, though curiously enough these are woven also; their constructions are long bags like the old-fashioned netted purses, with the entrance hole at the top near the point of suspension to the bough. Woven pendent nests, but with the entrance at the opposite end, are also made by the Weaver-birds, whose stronghold is in Africa, though the Baya (*Ploceus baya*), one of the best builders, inhabits South-west Asia. The males in these birds also are commonly yellow and black, forming a curious but possibly significant correlation of a type of colouring elsewhere very unusual in birds with the supremest of skill in nest-building.

In the nest of the Bayas proper (*Ploceus baya* and *P. atrigula*), which are about as perfect as any of these Weavers in building ability, we get first a suspension cord attached to the end of the thin bough or section of a palm-frond which bears the nest; then the bulb of the nest itself, which at one side passes downwards into the long entrance-spout. A section of the interior would show that the nest-cup is divided from the entrance-spout by a firmly bound partition, which prevents the young falling out, and is also used by them as a perch when older. When the nest is about half-finished—*i.e.* all but the cup and spout, the top half being done—

this partition, then a mere bar dividing two holes, like the handle of an inverted basket, forms a useful perch for the bird working inside, a position which is taken up by the hen, which passes out the ends of the material as they are thrust in to her by the cock.

It is probably owing to the want of this feminine assistance that the nest is so often left unfinished in captivity, and that so many half-built nests are found in the wild colonies, the building of these being the amusement of the males when unoccupied. Many of these will also go on lengthening the tubular entrance after the sitting has begun; it will be noticed that this is always left loose and unbound at the end, such apparent negligence being an additional safeguard against attacks by snakes and other enemies. Another safeguarding instinct noticeable in these birds is that of hanging the nest whenever possible over water; it has been found that even the water in the bathing-pan in an aviary incites some Weavers at all events to nest directly over this.

The Baya itself is not commonly imported compared with some of the African Weavers, far the commonest bird of the kind in the trade being the small Red-billed Weaver of Africa (*Quelea quelea*), which anybody can buy cheaply and watch in any bird-room or back-garden aviary. Its nest, however, like that of many other Weavers, cannot be compared with that of the Baya, as it lacks both the suspension rope, being merely woven in amongst

twigs, and the downwardly elongated entrance-spout, being simply a round nest with an entrance-hole below. It is, however, the skill in working the material that is the great attraction in Weavers' nests, not the exact form assumed, which is not more wonderful than that of many other nests.

The Baya may at times exhibit what looks more like reason than instinct in getting its material; cocoanut fibre or ordinary grass will do, but it has been found building with grass which was far too broad; and in this case the bird alighted on the great blades, bit down to a sufficiently practical breadth, then went further down the blade till it had the right length, bit into the blade again, and then flew off, tearing away the strip as it went. As this grass also had a serrated edge, so that it could only be passed through one way, it is difficult to refuse reasoning powers to this particular colony of Weavers at all events.

In the Weaver the constructive instinct is very much stronger in the male than in the female, but, though many birds share the labour of nest-building with their mates, the constructive instinct is commonly more feminine than masculine, and some birds leave the construction entirely to the hen. The male, however, often supplies material, as generally with Sparrows and Pigeons, or he may accompany the female to and fro in her trips to get it, no doubt to keep watch over her safety while thus pre-occupied. He always takes some interest if he cares about the nest at all, which

many males, especially among the Game-birds, do not. The male Globose Curassow (*Crax globicera*), however, seems to be the chief constructor himself.

Nests of the felted type, well exemplified by that of our Chaffinch in a cup form, are often built in a pensile and domed pattern as well as woven ones, especially in the tropics, where the abundance and variety of enemies render necessary in the case of all defenceless species either inaccessibility of the nest or its very perfect concealment.

In India, for instance, nearly the only nests one ever ordinarily sees besides those of Crows, Kites, and other strong birds are the pensile ones of the Bayas. Now and then one may find the pensile felted nest of a Sun-bird, but this is often well concealed by looking like a bunch of rubbish; indeed, it is made of all sorts of odds and ends—bits of dry leaf, masses of caterpillar "frass," and so forth, matted together with spiders' webs, a great stand-by for birds which build these pensile felted nests.

I have even seen a pair of the Amethyst-rumped Sun-bird (*Cinnyris zeylonica*), the commonest kind in Calcutta, come into my verandah to carry off scraps of the grey fluff which is swept out of rooms, for use as nesting material.

Extremely beautiful felted nests are built on the pensile principle by the tiny Flower-peckers (*Dicæidæ*) of the Eastern Tropics, minute birds haunting tree-tops. These nests are matted together with cobweb, and are so well made that

they can be folded up without injury; the entrance is near the top, and they look more like little wash-leather purses than anything one could imagine a bird could make—in fact, with the exception of some mud-nests presently to be described, they are the most artificial-looking products of any form of bird industry.

The felted erect oval nest of our Long-tailed Tit has been long and deservedly admired, but that of the Cape Tit (*Ægithalus capensis*) is even more remarkable, composed as it is completely of plant-down, so closely felted that it is like cloth, and provided with a tubular entrance, not at the bottom, as in Weavers' nests, but near the top. Stark observed the hen closed this by pinching its edges together when she left the nest, either to keep the latter warm or to keep foes out, which no doubt it would do, for at any rate he once saw the mistress of the little house herself fail to get in again easily. Under this vestibule is a little pocket, in which the cock is supposed to sleep, and very likely does, Tits generally sleeping in some hole, or at any rate not on a perch in the usual way.

Besides weaving and the simpler process of felting, birds occasionally practise sewing, though this form of industry is rare. The best-known sewn nest is that of the little olive-green Wren-like Warbler called from this habit the Tailor-bird, and one of the most common—and noisiest—inhabitants of Indian gardens. The nest itself is simply the

lining of a cup made by sewing two or more leaves together, or the edges of one large one, and is very hard to find. The bill is of course the needle, and the thread is the raw silk of caterpillar-cocoons, which holds by reason of the resistance of this stuff to the edges of the pierced leaf, for the story that the bird makes a knot is a slight exaggeration, just like the tale of its picking up a dead leaf and sewing it to a live one. Such leaves may be found sewn together, but this is when one leaf has withered after being sewn.

Several other small Warblers make sewn nests in India, and so do some of the large dull-coloured Sunbirds of the genus *Arachnothera*, known as Spider-hunters; in this case the nest is secured to a broad leaf by having part of the material pushed through holes bored in this, but the structure is not nearly so perfect as the little Tailor's.

So many birds mix the basket-work of their nest with mud—even the Baya putting in a few patches—that complete nests of primitive earthenware are not surprising, though some fibre is generally, if not always, used. Such nests are familiar to us in the case of the House-Martin and Swallow, the former being far the more perfect type. For these the birds simply take up the mud in mouthfuls, and judiciously build little at a time, lest they should overweight the foundations, as White long ago observed in his admirable chapters on these birds.

Some Indian and Australian Swallows, such as the Striated Swallow (*Hirundo striolata*) in the

TYPES OF PENSILE NESTS.

1. Philippine Red Sunbird; 2. Cape Penduline Tit or "Kapok-vogel"; 3. Indian Tailor-bird; 4. Blood-breasted Flower-pecker.

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NEST OF CENTRAL-AMERICAN SWIFT.

This species (*Panyptila sancti-hieronymi*) builds a nest not unlike that of a Weaver-bird in shape.

former country, and Fairy Martin (*Lagenoplastes ariel*) in the latter, make even better nests than the House-Martin, resembling mud jars attached by the base to their support, which is commonly a wall, these Swallows, like most of their group, readily availing themselves of man-made facilities.

Three Australian birds, not apparently very nearly related and not at all like Swallows, the Grey Struthidea (*Struthidea cinerea*), White-winged Chough (*Corcorax melanorhamphus*), and Magpie-Lark or Pied Grallina (*Grallina picata*) distinguish themselves by making nests in the form of mud bowls, so extraordinarily true that if they were not attached to a support they could not be distinguished from crude human-made pottery.

Another wonderful mud-worker is the South American Oven-bird, whose domed nest, seated on a bough or post, has a side porch which renders invasion of the nesting chamber almost impossible. This is a very heavy nest, takes months to make, and lasts for years. The bird is a homely one, and a popular favourite, being called, like our Redbreast, by a Christian name, in this case "Alonzo Garcia" or "Alonzito," and credited with not working on Sundays, no doubt because it takes a spell off now and then. A close ally of this bird, curiously enough, is the burrowing "Minera," which reminds one of the great difference of the nesting-habits of the House- and Sand-Martins.

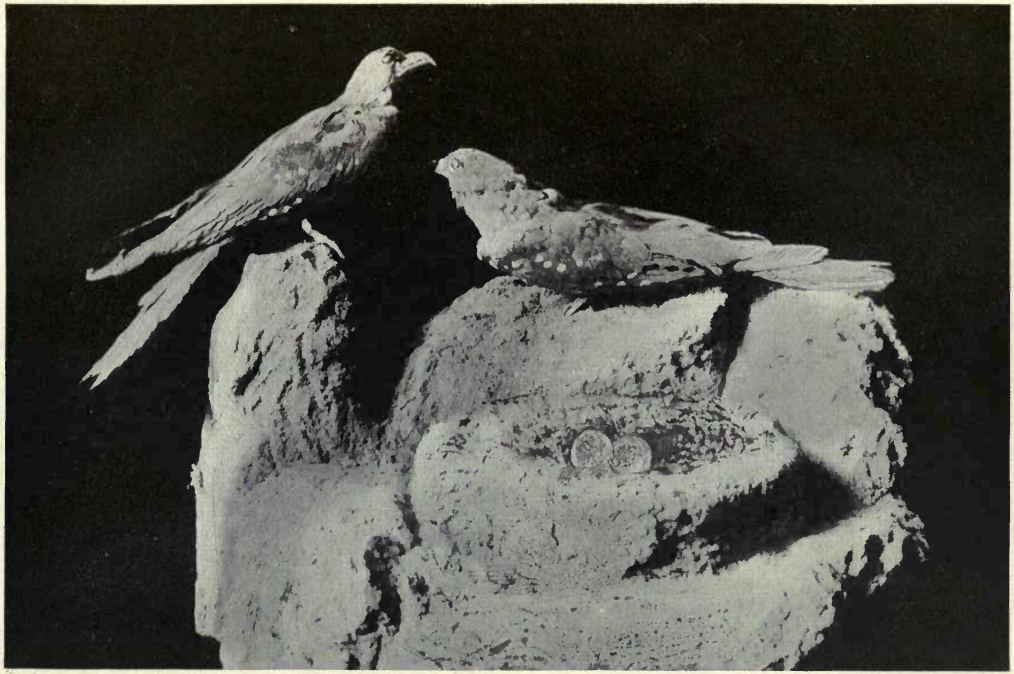
A combination of hole-building and mud-masonry is found in the nest of the Nuthatch, which has the

last sort of nest one would expect such a bird to make; and among the Parrots, which have been accused of being too clumsy to build nests at all, the Quaker Parrakeet (*Myopsittacus monachus*) of South America not only builds a stick nest with roof and porch, but goes in for tenement nesting, several birds building in one clump, though the actual rooms are separate.

A few non-Passerines build mud nests, such as that extraordinary fruit-eating ally of the Nightjars, the South American Guacharo (*Steatornis caripensis*), no doubt a primitive form, as its beak is less specialized or degenerate than a Nightjar's, and not so abnormally enlarged as a Frog-mouth's. Among the waders, Flamingoes and the Sun-Bittern also build mud nests, but in all these cases the nest is a mere cheese-shaped hassock, as it were, displaying no special merit in architecture.

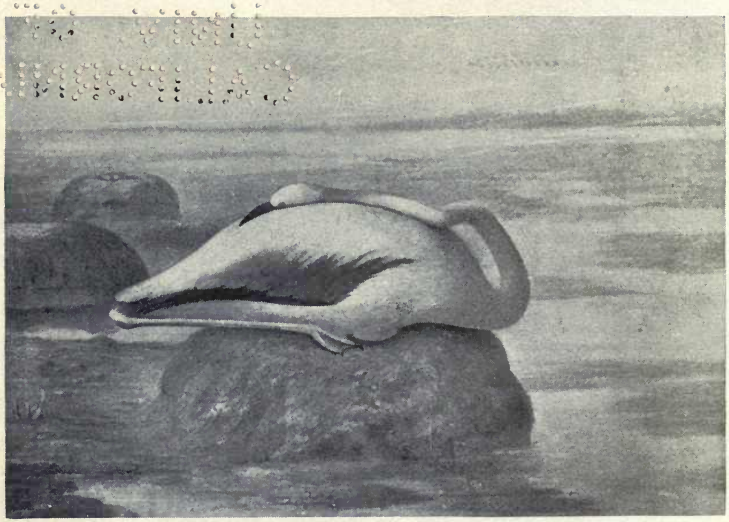
It is interesting, however, to find that other birds than Passerines have so much constructive ability, clumsy or not; and in this connection it should be noted that the Broadbills, Passerines of a very primitive and clumsy type, build pendent nests nearly as good as those of Weavers. Nor can we say that birds of special intelligence will necessarily build an elaborate nest, for the clever Crow tribe, with the exception of the common Magpie with its domed nest of thorny branches, build nests of the most ordinary type for passerine birds.

Parasitic nesting is extremely common among birds, especially among hole-building species which



GUACHAROS AND NEST.

The Guacharo, although a fruit-eater, has a hooked, toothed bill very like a Falcon's.



FLAMINGO ON ITS NEST.

Showing the sitting position, which is rarely assumed by the Flamingo except when incubating.

SWIFTLETS AND THEIR NESTS.

These Swiftlets are the smallest of the family, not being so large as the Sand-martin among the Swallows.

do not bore for themselves or are anxious to avoid the trouble; thus many birds avail themselves gladly of the nest-borings of Woodpeckers, from Tits to tree-breeding Ducks such as the Golden-eye and Carolina. Such Ducks, with Owls and Kestrels, are among the most inveterate of nesting parasites, few of these birds having much notion of making a nest for itself. They are often not particular about a hole, but will adopt an open nest; thus, the Long-eared Owl gladly utilizes the shallow nest of a Wood-Pigeon.

The hole-builders indeed often act on the principle of " any port in a storm " ; they will parasitize mammals as well as other birds, since the Stock-Dove, Tawny Owl, Sheldrake, and Puffin all utilize rabbit-holes in this country, and in America the Burrowing-Owl inhabits those of the prairie-marmot—the so-called prairie-dog (*Cynomys ludovicianus*)—in the northern part of the western continent, and of a much bigger rodent, the vizcacha (*Lagostomus trichodactylus*) in the southern hemisphere.

In England the Sparrow-Hawk, generally, unlike the Kestrel, an independent nest-builder, has been found nesting on top of the drey of a Squirrel which was occupied at the time by the little rodent, which reminds one of a converse case recorded in Argentina, when an opossum, a great foe of birds, had established itself in one of the rooms of a composite nest of the Quaker Parrakeet above alluded to, the stout walls and overhanging eaves preventing

him from clearing the colony, which included besides the rightful owners a tree-building Teal (of some species) as an additional but harmless parasite.

The Sparrow, as we all know, too often evicts the House-Martin and takes possession, but it is not so familiar a fact that the Swift does the same thing by him ; this seems not to have been recorded since the days of Gilbert White, but it used to happen regularly under the eaves of Mr. B. Clarke's photographic studio at Maidstone when I was a boy at school there with his sons.

In Argentina the Oven-bird's cosy nest is coveted by a Saffron-Finch (*Sycalis pelzelni*) and a Tree-Martin (*Progne tapera*), this powerful Swallow even fighting the owners for its possession, and sometimes successfully ; and, strangest of all, the Wood-Sandpiper (*Totanus glareola*) and some allied species of Sandpipers breed in old nests of other birds and of squirrels.

The remarkable phenomenon of parasitism in the young of birds has been known in the case of the common European Cuckoo from classical times, and is quite proverbial, though even in the habits and procedure of this well-known bird there are many points yet to be made out ; but it occurs not only in many other Cuckoos—though only in those of the Old World, and not universally there—but has originated independently in the Cow-birds, Passerines belonging to the family of Troupials (*Icteridæ*), which is intermediate between the Finches

and the Starlings in form and habits, and in the curious little birds known as Honey-guides (*Indicatoridæ*), closely allied in their anatomy to the Barbets, and best known from Africa, though a few occur in South-east Asia and its islands.

Among the Cuckoos, only those are parasitic which are essentially perchers, having short legs and powerful wings, and seldom coming to the ground; among these the habit seems to be universal in the Old World, from the tiny and beautiful Violet Cuckoo (*Chrysococcyx amethystinus*) of Malaysia, to the huge Toucan-like Channel-bill (*Scythrops novæ-hollandiæ*) of Australasia, though the American Cuckoos of this type do not display it. The short-winged, strong-legged, Magpie-like Bush-Cuckoos, such as the "Crow-Pheasant" of India and the Guira of South America, are never parasitic, though the latter and its black allies the Tick-birds (*Crotophaga*) indulge in the custom of communal building and nestling-rearing.

The general habits of the European Cuckoo are well known; the egg, which is very small for the size of the bird, is usually laid on the ground and then taken in the bird's bill and placed in the foster-nest, though when this is conveniently situated, the Cuckoo may sit on it to lay her egg. The male may accompany the female to guard her or distract the hostility of the owners, but this is apparently exceptional, the general impression among naturalists being that Cuckoos live in a state of promiscuity and do not regard conjugal

ties. The natives of Yarkand go further, and say there are no male Cuckoos at all, the hens being the paramours of a Shrike (*Lanius isabellinus*), the Barred Warbler (*Sylvia nisoria*), or even of frogs! a belief which at any rate argues that two Cuckoos are not often seen together.

The egg, when incubated by the fosterer, develops after a proportionately short incubation period into a blind naked young bird which has a hollow in the back, facilitating the work in which it almost immediately engages of turning eggs or its foster-nest-mates out of the nest by getting under them and backing upwards to the edge of the nest till they are rolled out. When, as rarely happens, two Cuckoos' eggs have been deposited in the same nest, the "survival of the fittest" is naturally not determined till after a severe contest. But this fury for eviction only lasts about a week, after which time the young Cuckoo will tolerate a bed-fellow.

The foster-parents do not concern themselves about this fratricidal behaviour in their nursery, but assiduously feed their changeling and leave the rightful heirs to die; nor is there anything wonderful in this behaviour, as it is the common custom of birds to neglect a fallen nestling and to give most food to that which is most strongand ravenous. I once had an opportunity of watching a nestful of Starlings which were being reared on a roof just under my window at Oxford; and as far as I could see there was not the least attempt at fair

feeding on the part of the parents. A very ravenous young bird appeared always to be on top of the rest, and to get nearly all contributions till he subsided and another got the opportunity of taking his place. The Calcutta pair of Dabchicks, however, fed their young fairly, and I have seen a young bird pecked instead of fed when it clamoured too soon for a second helping.

The fact that the young Cuckoo is assiduously fed long after it can fly is probably due to the insistent quality of its appeal; birds which have not reared one will feed it, and on one occasion when a young Cuckoo was confined in a Parrot-cage in the inside compartment of the Western Aviary at the Zoo, a Black Tanager (*Tachyphonus melanoleucus*), a South American species which could have had no knowledge of such a bird, nevertheless squeezed through the bars to feed it.

The range of foster-parents in the case of the common Cuckoo is wider than in any other, and may partly account for the wide range of the species itself, Cuckoos generally being quite as tropical as Parrots or Humming-birds, though in view of the extension into North America of the non-parasitic Cuckoos, this is evidently not the only explanation. The favourite fosterer is the Titlark or Meadow-Pipit, and presumably it is due to its dependence on this bird that the Cuckoo ranges out on to the moorlands, a habitat for which it, like most of the family, is utterly unsuited, being an awkward mover on the ground, though on trees it hops more actively

than its short legs would lead one to expect. The Hedge-Sparrow is, however, a well-known victim of the Cuckoo, and is the most often spoken of, since as it is such a familiar bird itself, the alien nestling is most often seen in its easily-found nest in most places.

Other well-known Cuckoo-rearers are the Robin, Pied Wagtail, and Reed-Warbler, and many other small birds are patronized, but chiefly the insectivorous kinds, though now and then a Finch's nest may be selected. Larger birds are very seldom Cuckoo-fosterers, probably because they can drive off the intruder—otherwise we should expect to find the Blackbird, Thrush, and Starling the commonest fosterers, their nests being easy to find and their habits in every way suitable. The Red-backed Shrike, however, in spite of its ferocity, is a not uncommon foster-parent on the Continent, though rarely so in this country.

In this case, the egg of the Cuckoo seems generally to bear a close resemblance to that of the Shrike, but such resemblance to the egg of the fosterer is not by any means universal. The Cuckoo's egg is indeed very variable, though not nearly so much so as that of the Guillemot; and its small size relatively to that of its producer is paralleled by the similar smallness of the egg of the Raven above alluded to. The mottled-drab coloration which is the most usual is certainly not very unlike that of Wagtails' and Pipits' eggs, though the resemblance is far closer to that of the

Skylark than to any other bird's, but no Robin or Hedge-Sparrow, even if colour-blind, could fail to notice the difference of the alien egg.

It is said that eggs resembling those of the foster-parents, such as the blue form found in the Redstart's nest, tend to be confined to fosterers which are rarely patronized, leading to the inference that such are not easily duped, so that a perfect imitation has been evolved; but such an explanation involves the assumptions that certain strains of Cuckoos always lay in particular birds' nests, and always produce eggs of the same colour, of which there is no evidence at present. Certainly, as in the case of Tree-Sparrows and Eagles, the same individual birds do not always lay similar eggs; a very remarkable instance of this has occurred in the case of the Nightingale, in whose nest have been found an egg of the normal olive-brown, a blue one, and two of intermediate shades.

In some Oriental Cuckoos there is a very perfect assimilation between the egg of the parasite and the fosterer; the "Brain-fever-bird" (*Hierococcyx varius*) and the Pied Crested Cuckoo (*Coccystes jacobinus*) lay in the nests of Babbling-Thrushes (*Crateropus* and *Argya*) and their eggs are plain blue like those of the Babblers; and the Koel (*Eudynamis honorata*), the commonest and best-known Cuckoo in India, is parasitic on House and Jungle Crows (*Corvus splendens* and *C. culminatus*), and lays an egg very like a small Crow's egg. It is doubtful, however, whether the imitation is here

of any service, for just as Graham records in the "Birds of Iona and Mull" that he got Hooded Crows to hatch Bantam eggs smeared with indigo, so Mr. D. Dewar has got the House-Crow to hatch an ordinary Hen's egg.

In the Koel, by the way, the parasitism is not so perfect as in the common Cuckoo; the young bird does not always eject the young Crows, and the old birds feed it after it has been reared in the Crows' nest. I have myself, however, seen the Crows feeding a young Koel, which is curious, as they hate and persecute the old bird. The Koel avails itself of this to get its egg deposited, the male bird drawing off the Crows in pursuit of him, while the female deposits her egg, presumably laying it in the nest, this being convenient, while the bird, like so many tropical fruit-eaters, seems never to come to the ground, and so is not likely to descend in order to lay there.

Another case of incomplete parasitism among Cuckoos is recorded of an African species, the splendidly glittering little Emerald Cuckoo (*Chrysococcyx smaragdineus*), which Keulemans, the late well-known bird artist, told Buller, as related by the latter in his "Birds of New Zealand," is in the habit of hatching its solitary egg, and then leaving the young bird to the mercy of the bird public; passing birds, he said, attracted by the cry of the Cuckoo nestling, dropped contributions into its mouth, an episode he had himself often witnessed on Prince's Island.

An allied but less brilliant species, one of the Bronze Cuckoos (*C. cupreus*), also African, is parasitic on such different small birds as Sun-birds and Finches; a similar species, the Shining Cuckoo (*C. lucidus*) of New Zealand, generally lays its egg in the nest of the small Grey Warbler (*Gerygone flaviventris*), which makes a pensile nest with side entrance. This same little bird is parasitized by the other New Zealand Cuckoo (*Urodynamis taitensis*), which is larger than our Cuckoo, while the Shining Cuckoo is much smaller.

This large New Zealand Cuckoo, however, has also been found in the nest of the Wood-Robin (*Miro albifrons*), and it was particularly noted that although it throve well, and ultimately sat on top of the young Robins, these also lived, and when the young Cuckoo and a young Robin were removed and caged, the old Robins fed both of them. When a nest of the Grey Warbler containing a young Shining Cuckoo was watched in the same country, however, it was noticed that the young Warblers, although not immediately at all events ejected by their bedfellow, nevertheless died off one by one, and some were found outside.

The large New Zealand Cuckoo is extending its parasitism to the introduced British birds, and also preys on their young, as it did on those of the native birds, and their eggs, when first studied; these predatory habits make it less surprising that our Cuckoo should be credited with eating some of the eggs of the foster-parents in whose nests

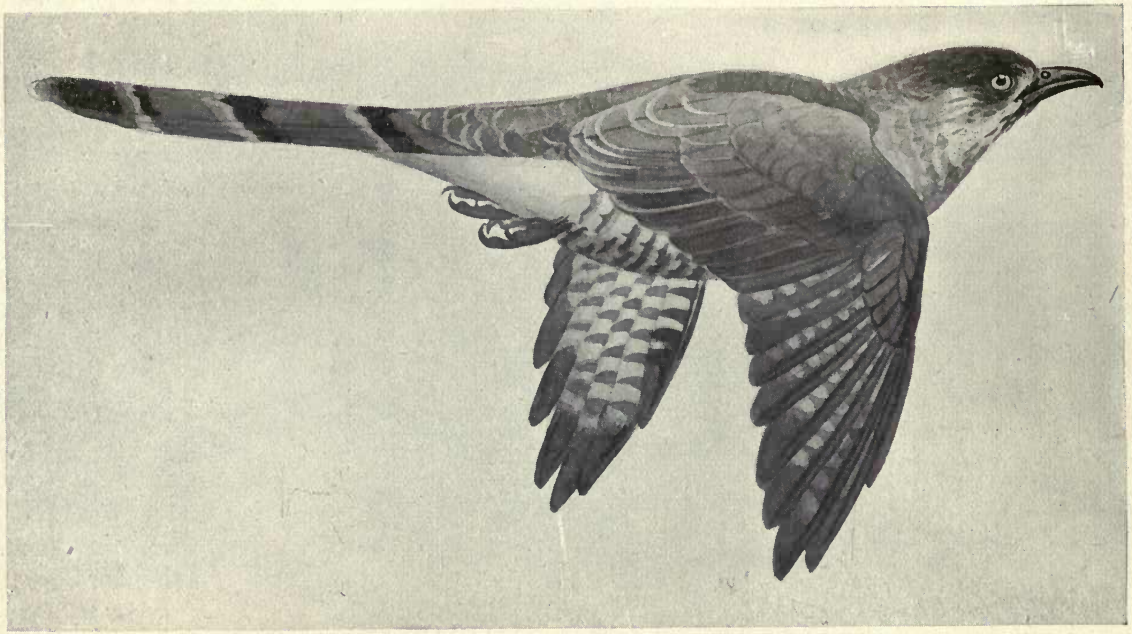
it deposits its own. Many must be familiar with the old rhyme about the Cuckoo, about which it is said that

> She sucks little birds' eggs
> To make her voice clear.

A taste for the eggs of other birds is not at all uncommon among the insectivorous species—at any rate it frequently develops in captivity, and as to the antiquity of the tradition, it must be remembered that formerly Cuckoos were evidently far more familiar to the British public than they are now, judging by the allusions to them in our literature. Shakespeare in the "Midsummer Night's Dream" makes Bully Bottom the Weaver allude to the "plain-song Cuckoo grey."

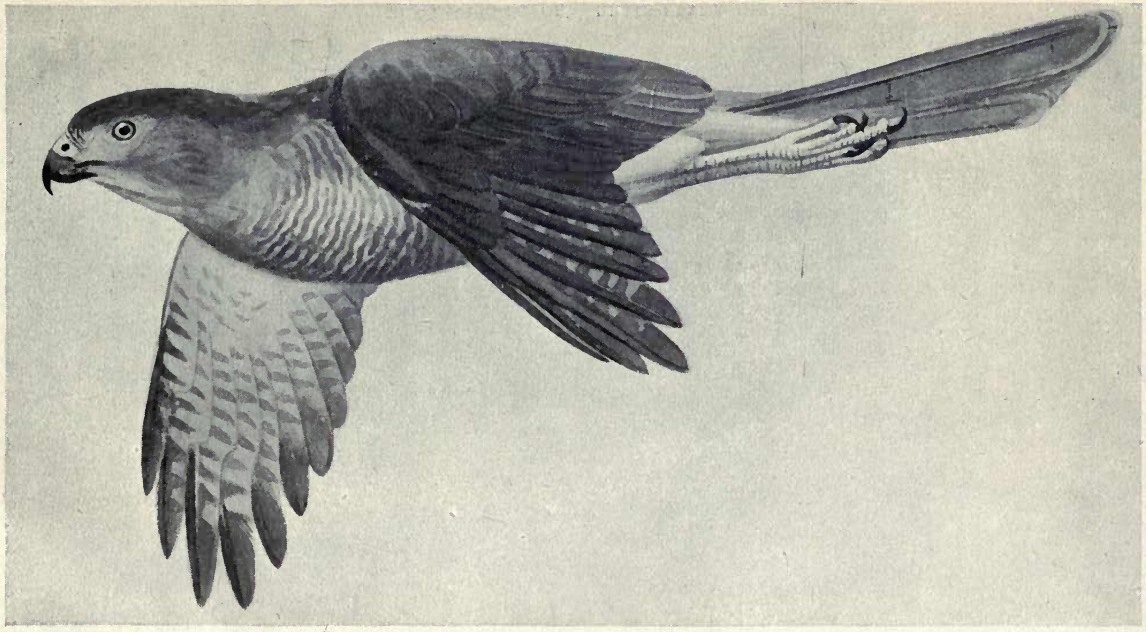
I fancy most people nowadays, whether weavers or writers, would not be able to say off-hand of what colour a Cuckoo is. The colour of the young Cuckoo, however, with its black barring on a ground of brown above and whitish below, is evidently pretty familiar, this changeling being so often found in the nest of its fosterer, and exposing itself when fledged quite freely until it leaves us in the autumn, in a manner very unlike the stealthy habits of its parents in the spring; so that it is not astonishing that "Cuckoo" is the poultry-fancier's term for a barred grey fowl such as the Plymouth-rock, though any brown shade in this breed would now be a disqualification.

It may be mentioned that there are wild birds



HAWK-CUCKOO OR "BRAIN-FEVER BIRD."

The name "brain-fever-bird" is given to this cuckoo because its notes resemble a repetition of the word "brain-fever."



SHIKRA HAWK.

This Indian species closely resembles our Sparrow-hawk; hawks of this type are the most widely distributed of all the family.

coloured just like a barred grey fowl of ordinary type and not of very high standard of marking, and that these are the grey species of the flightless Kiwis or Apteryxes. The coincidence of such a peculiar marking occurring in two such very different birds as the flightless nocturnal New Zealand Kiwi and varieties of our domestic fowls, should prepare us for coincidences in coloration, and help to make us sceptical about the survival value of the curious resemblances to Hawks seen in many of the Cuckoos. Some of these are certainly most extraordinary; the Brain-fever-bird or Hawk-Cuckoo of India above mentioned is extraordinarily like the common Hawk of the Indian plains known as the Shikra (*Astur badius*) and the resemblance is not confined to the adult birds, but extends to the young in first plumage, which are differently clad from them in both mimic and model. Another member of the genus *Hierococcyx* to which this bird belongs, *H. sparverioides*, resembles another Sparrow-Hawk, the Besra (*Accipiter virgatus*).

The Hawk-like appearance of our own Cuckoo has often been commented on, but it is very sketchy compared with that of the above species, and the young and adult stages do not resemble the same kinds of Hawks, and the shape is less Sparrow-Hawk-like. Moreover, the young of the non-parasitic Crow-Pheasant is just as much like a Hawk, when of the barred type (some resemble the black, chestnut-winged adult, but are usually duller), as our young

Cuckoo, and I have in Calcutta seen tame Guinea-Fowls and wild Crows distinctly impressed and apparently alarmed by one of these young birds which came into my possession, just as in the Zoo the keepers find that their small birds from many countries kept in the West Aviary are frightened if a common Cuckoo is introduced to them.

A fairly good general resemblance is therefore sufficient to impress birds, but the point of it seems to be wanting. If the Hawk-like appearance of certain Cuckoos scares the fated fosterers from their nest, what end is served by the Hawk-like appearance of the fostered young? Besides, many parasitic Cuckoos are not like Hawks, or resemble Hawks found in a different country. Thus, the large New Zealand Cuckoo, as noted by Buller, is extremely like an American Hawk (*Accipiter cooperi*), but does not so closely resemble any native Hawk; and the same Babblers which foster the Brain-fever-bird also rear, as has been said, the pied Crested Cuckoo which, with its crested head and plumage black above and white below, is like no Indian Hawk. Neither is any Hawk anywhere like the splendid Emerald, Bronze, and Violet Cuckoos, for adult Hawks and other birds of prey, like the downy young birds we have been considering, follow mammalian rules of colour, and eschew brilliant tints except on bare parts.

Some even of the non-parasitic Cuckoos may have a rather Hawk-like coloration, like the large fruit-eating Cuckoo, *Carpococcyx radiatus*, of the

Malayan islands, which is indeed rather Pheasant-like in shape, but Hawk-like in pattern. The curious resemblance between most parasitic Cuckoos and the Hawks in having long thigh-plumes must be pure coincidence, as the short legs of the Cuckoos are not suited for exhibiting this point, and besides, the Hawks they most resemble are long on the leg; Hawks also sit erect, not horizontally like Cuckoos.

It must not be forgotten that the Sparrow-Hawk pattern, or Cuckoo pattern, whichever one chooses to call it, of a plain or nearly plain upper surface and a barred lower side, is one of the most strikingly recurrent patterns in the bird class, like the Magpie pattern to which Mr. D. Dewar and myself have drawn attention in our critical work on "The Making of Species." It is found, for instance, among the Passerines, in many of the thence-named Cuckoo-Shrikes (*Campephaga*); in the male Barred Warbler of Europe (*Sylvia nisoria*); in both sexes of a little Australian Finch, the Cherry-crowned (*Aidemosyne modesta*); in an Australian Duck, the Pink-eyed (*Malacorhynchus membranaceus*); in the female of the well-known Upland Goose (*Chloephaga magellanica*)—which also happens to have the gamboge-yellow feet so common in birds of prey, and so rare elsewhere, instead of the orange not uncommon in waterfowl—and in both sexes of an allied compatriot, the Ruddy-headed Goose (*C. rubidiceps*); in an Indian Owl (*Glaucidium cuculoides*), and in some little Doves of the genus *Geopelia*.

The most fervent advocate of mimicry will hardly maintain that small Doves and Passerines and big waterfowl mimic Hawks; so why not put the whole thing down to coincidence? The resemblance of our Cuckoo to a Hawk does not save it from the real bird, for Mr. J. H. Owen in "British Birds" for 1914 expressly mentions Cuckoos among the victims of the Sparrow-Hawk.

The Honey-guides, which are a family of very few species, appear to be all parasitic, but practically nothing is known about the ways of the Asiatic species, not even the extraordinary and well-known instinct of guiding men and the Ratel or Honey-badger (*Mellivora*) to bee-nests being recorded of them. The egg of the African Honey-guides, which is white, has been found in the nest of the White-throated Swallow (*Hirundo albigularis*) by Mr. Ivy in the case of Sparrmann's Honey-guide (*Indicator sparrmanni*) as recorded in Stark and Sclater's "Birds of South Africa"; the same gentleman recorded the egg of the Yellow-throated species (*I. major*) in the nest of a Drongo-shrike; while Mrs. Barber found the same species parasitizing the Black-collared Barbet (*Lybius torquatus*). She also found the Lesser Honey-guide (*I. minor*) parasitizing the Tinker, another Barbet of very small size (*Barbatula pusilla*).

Mr. Ivy found a pair of the above-mentioned Black-collared Barbet actually trying to fight off this Honey-guide from their nesting-hole, the intruder persistently returning; evidently her case

was a desperate one, for when she was shot the egg was found to be actually half-laid. No doubt it is an emergency like this in the case of the common Cuckoo which accounts for the egg being found in such unlikely and unsuitable nests as those of the Wood-Pigeon and, of all others, the Dabchick! The strong tendency of the Honey-guides to sponge on their own relatives, the Barbets, is noticeable; the present species has been said to lay in the nests not only of those mentioned, but also in those of the Pied Barbet (*Tricholæma leucomelan*) and of a Woodpecker (*Mesopicus griseocephalus*).

It is of interest here to note that the plumage of the Honey-guides is plain and ordinary in character in all the species, resembling that of the less conspicuous Finches, and not in the least like the striking and often variegated tints of the fosterers they select. They appear, however, always to use the nests of birds which lay white eggs, though their own are distinguishable from these readily enough.

The young Honey-guide has the ends of both jaws sharply hooked, which is not the case with the adult; it is supposed that this structure is comparable to the hollowed back of the young Cuckoo, an adaptation to facilitate the ejection of the foster-fellow-nestlings, in this case to ensure a strong grip with the beak. The young Honey-guide certainly seems when found to have the nest to itself, like some young Cuckoos and Cow-birds, but it must be remembered with regard to the

structure of the beak that this is in other cases sometimes more hooked in the young than in the adult, as in young Gannets and Herons; and incidentally it would be well to examine all young Cuckoos available, to see if the non-parasitic species were hollow-backed at first as well as the others.

The old Honey-guides appear to associate with the young when reared, and perhaps instruct them unconsciously or otherwise; Mr. Ivy found two old and three young birds of the Scaly-throated species (*I. variegatus*) together, of which only one old bird would guide him.

The parasitism of the Cow-birds is in a way more instructive than that of the Cuckoos and Honey-guides, because here the gradations of the instinct can be very plainly traced. These birds, which are among the most Finch-like of the Troupials, having short thick bills, and being able to live on dry seed which they crack in typical Finch fashion, are all closely related and easily recognizable.

One of them, the original Cow-bird (*Molobrus pecoris*) of North America, is as truly and completely parasitical as our Cuckoo, laying one egg in the nests of various small insectivorous birds, which rear that young bird alone, so that the others evidently perish, even if not ejected; a fate which is likely to befall weak young birds in any case, as exemplified by my Canary experience. This is a glossy-black species with a sooty-brown head in the male, brown in the female, and used to consort with bisons when they were common, as it now

does with cattle, whence its scientific and popular names. Like the rest of the genus, it is chiefly a ground-bird and a walker, so that in general habits it presents no resemblance whatever to the parasitic Cuckoos.

In South America are found several species, and it is to the able historian of the birds of Argentina Mr. W. H. Hudson, that we owe the elucidation of their curious half-developed instincts. The best-known species, the glossy Cow-bird (*Molobrus bonariensis*), is very common and often imported here as a cage-bird; the male is a resplendent purple and the hen sooty. It is truly parasitic in that its young are always reared by other birds, but its parasitism is slovenly and incomplete. Several females will lay in the same foster-nest, and fairly swamp it with their undesired contributions, whereas it is rare in the case of the Cuckoo to find two parasite eggs in one nest. To this suicidal instinct they add another equally silly, of destroying any sort of eggs they may come across, those of their own species included; and moreover they recklessly drop eggs about on the ground, a habit shared by another South American bird, the Rhea. And just as the hen Rheas are, so to speak, parasitic on their own males, and pool their eggs in his nest, so these hen Cow-birds occasionally make a futile nest of their own, in some silly place such as on the leaves of a large thistle, and leave even this poor attempt unfinished.

Then there is a species, brown with chestnut

wings in both sexes (*M. badius*), which is also common, and is not parasitic, except to the mild extent of stealing another bird's nest when it can; this species is itself parasitized by another (*M. rufo-axillaris*) in which both sexes are black.

I particularize the colours of these species because it is interesting to note that the one with the simplest and probably most primitive coloration retains its primitive habits, and the most advanced in coloration is actually parasitic on this; a fact which, however curious it may appear, is not so paradoxical after all, for allied species recognize each other's affinity, and as long as a member of a parasitical group retained the ordinary nesting-habits of birds, it is, after all, at least as reasonable that a parasite should quarter itself on this as on an alien. There is, however, no case known of a parasitic Cuckoo quartering its offspring on an independent one, although species of both types are habitually found in the same countries in the Old World.

The one Cow-bird which penetrates into the northern half of the American continent is, like our exceptionally widely-ranging Cuckoo, a bird of extended parasitism, favouring various species of small Finches and insectivorous birds; with the Cat-bird (*Galeoscoptes carolinensis*), a larger species than most of its fosterers, it is seldom successful, and the Golden Warbler (*Dendræca æstiva*) sometimes disposes of the Cow-bird's egg, not by turning it out of the nest, but by building a fresh floor over

it, and in the case of a repeated invasion by the parasite, may have recourse to this expedient more than once.

Another case of parasitism, and in this case also on allies, is furnished by the Troupials, the large black *Cassidix oryzivora*, a bird about the size of a Jackdaw, being a parasite on some of the other Troupials known as Hang-nests.

Cow-birds do not mimic their dupes in appearance any more than Honey-guides; and indeed this resemblance to an alien fosterer only appears in one or two Cuckoos, and is doubtful there. One Eastern Cuckoo, indeed (*Surniculus dicruroides*), has been called the Drongo-Cuckoo, and attained a great celebrity in books and museums, owing to its resemblance to the common, conspicuous, and highly pugnacious black Drongo-Shrikes (*Dicrurus*), which it is believed to parasitize, though the chief evidence of this is that a pair of Drongos has been seen to kill one of these Cuckoos, which does not look as if the resemblance did much good to its possessor.

The size and general shape of Drongo and Drongo-Cuckoo are certainly very similar, but after all there are plenty of birds of which this could be said; the black colour goes for nothing, as there are several other black Cuckoos, parasitic and otherwise, such as *Cuculus clamosus* allied to our Cuckoo, *Coccystes serratus* among the crested parasitic Cuckoos, and the whole genus *Crotophaga* or Anis among the non-parasites. Moreover, the tail

of the Drongo-mimic is only square or slightly forked, whereas the tail of the Drongo itself has an extra strong and deep fork with an outward turn like that of our Blackcock, so that these spirited Shrikes would have to be uncommonly bad observers not to detect the impostor at a glance.

However that may be, the other case does not seem very much better; one of the Koels of the genus *Eudynamis* allied to the Indian Koel above mentioned lays in Borneo in the nest of a Talking Mynah (*Eulabes*), and the young of both sexes are said to be black, as males of this genus of Cuckoos always are, the hens being speckled like hen Pheasants. This is supposed to deceive the parent Mynahs, which are black birds, while the Cuckoos are growing up, the hen getting her colour later on.

Something similar has been said about the Indian Koel, which, as we have seen, parasitizes Crows, birds which are certainly more clever than any Mynah; but as a matter of fact, in Bengal at any rate, young Koels do not resemble the male in all cases. Young cocks are black, indeed, but have some buffy markings, and young hens are almost as variegated as the old birds, equally so in fact save for a solid black cap. It would surely be far more to the point for the hen to be like a Crow, so as to approach the nest in greater safety, if evolution here were proceeding on orthodox lines. And as to the resemblance of the young to that of fosterers, the Hawk-like young of other Cuckoos manage to

get brought up all right, in spite of the absence of resemblance to the fosterers' true young, and of the presence of a resemblance to the most hated and feared of birds.

Resemblances to some other bird than a near ally seem to be a marked peculiarity of the Cuckoo family; not only do some of the parasitic Cuckoos look like Hawks, and at least one, as we have seen, rather like a Drongo, but the largest of this type, the Channel-bill, is so like a Hornbill that it was early described as one—yet there are no Hornbills in Australia, where this bird occurs, and the nearest Hornbill, found in New Guinea, is not that which the Channel-bill resembles, the likeness being to some of the small grey Indian species.

A parasitic Cuckoo may even resemble a non-parasitic one, as in the case of the crested *Coccystes coromandus*, which is coloured just like a non-parasitic "Crow-Pheasant" (*Centropus monachus*), though the former is Indian and the latter African, so that an excellent case of what is called in insects "Mullerian mimicry" falls to the ground. It would be just as well for parasitic Cuckoos if they did get mistaken for stronger birds, as they are often bullied, even by species which they do not infest, but from what has been said, there does not seem to be any really definite development of this mimicry in appearance.

CHAPTER VII

Migration—An anciently observed phenomenon still imperfectly understood—Reasons for it—Methods as far as is known—Difference between migratory species and the homing Pigeon—Widespread tendency to migration, contrasted with contradictory tendency to form localized non-migratory races, ending in some cases in flightlessness, as in some birds of remote islands

MIGRATION has always been a conspicuous phenomenon in the lives of certain birds, and often, as in the case of Wildfowl and Quails, intimately bound up with the question of human food-supplies, so that it is a very familiar fact; but in spite of this familiarity, it is still far from being properly understood. The old idea of the hibernation of some birds is indeed definitely done away with, and nowadays no one seems to believe that small birds ever ride on big ones; yet Bee-eaters in Africa have been found riding on Storks or Bustards when these were searching for prey on the ground, and taking their share of the insects driven up; so where is the difficulty of a weary Wren or Warbler taking refuge on a Swan or Gannet, which certainly could not dislodge it in mid-air? I mention this because there is no physical impossibility involved,

as in the case of Swallows, which were supposed to winter under water, and the case is worth considering.

As to the reasons for migration, we have here some chance, when we know more completely the life-history of the birds, of finding them out; and at the outset, migration is in its essence simply the periodical removal of an animal from conditions which have ceased to be attractive to a locality where it is, or expects to be, more comfortable. It is not confined to birds, for some fish are well-known migrants—one has only to cite the salmon—and mammals also undertake migrations, as the American bison used to do, and as sea-lions do still.

A very interesting case is that of a small and very local British land-snail (*Helicodonta obvoluta*), now only found here on a limited area on the South Downs, which executes a miniature migration from its hibernating haunt on the ground to the branches of the beech-trees in spring, spending the summer aloft, and in autumn coming down the trunk to bury itself again. There is no essential difference between the short journey of this humble mollusc and the enormous transit of the world's record migrant, the Arctic Tern, which breeds up to the northern limit of land, and in our winter reaches, on its southern migrations, even to the cheerless shores of the Antarctic continent, there to enjoy whatever sort of summer that unpromising region can offer it.

Migrations in elevation, made no doubt very

often with little or no use of the wings in the case of ground birds, are quite the normal thing in hill-living birds, as in so many species inhabiting the Himalayas; the splendid Monaul or Impeyan Pheasant (*Lophophorus refulgens*), for instance, ranges up to the very edge of the forest belt in summer, and comes down in winter into the lower deciduous woods, where there is more chance of food. Wild Turkeys in America used to wander long distances in search of mast, acorns, etc., though their powers of flight are so limited that in crossing a river a mile broad, some of the weaker birds were certain to fall in and have to finish the transit as best they could by swimming, and it took days of gobbling exhortation from the old cocks to get the emigrants' spirit up to the pitch of starting at all.

Want of food is obviously the chief reason why birds of high elevations or high latitudes have to leave their haunts; cold is by itself very little operative, for it is not surprising that birds prove comparatively indifferent to it, considering their naturally high temperature and particularly warm clothing. Not only do numerous tropical Finches and Parrakeets winter safely in outdoor aviaries, but of our poultry the majority come from hot climates, the Fowl and Peacock, for instance, being typical inhabitants of the plains and foothills of India. With the end of autumn, however, comes not only scarcity of food, but absence of cover, owing to the deciduous character of so much temperate vegetation, so that both for fear of

getting nothing to eat and of becoming food for others, the birds of temperate climates have to seek a warmer country for the winter.

Species whose habits render them independent of leaves and herbage and fresh water tend to be resident; thus, the Eider-Duck and Razor-bill will winter on the edge of the Arctic ice, and Woodpeckers and Tits, whose food is sought on boughs and trunks rather than on leaves, can pass the winter in leafless forests that Warblers and Cuckoos must leave, while the Grouse feed on conifer-needles and buds or burrow in the snow for their food. Berry-eating birds like Thrushes can live till the supply is gone, and a confirmed berry-eater, the Waxwing, roves about the north all winter, its long wings, almost Swallow-like in form, giving it ranging powers that enable it to dispense with a distant southern journey in many years, though it may even reach Northern India. Some birds of prey, too, remain even in the high north as long as there is anything to be picked up, such as the Snowy Owl, though even this has strayed south to the Punjab.

The universality of the migration depends of course on local conditions; thus in the comparatively mild climate of our islands many species are to be seen throughout the year which are migratory in corresponding latitudes on the Continent, the Robin and Song-Thrush for instance. Swallows often remain after their time of leaving, and, as Gilbert White observed, they stay particularly late

about Oxford, and I have been the unwilling witness of the gradual failure and death, evidently from hunger, of some of these poor would-be colonists in permanency.

Birds of passage in the Southern Hemisphere naturally migrate north in winter, from the same motives as induce the northern birds to go south, but there is a curious exception in the case of the Emperor Penguin, which chooses mid-winter in its haunts on the Antarctic ice-floes as the time for laying and rearing its chick. Some other birds, too, seem to come into breeding condition at most unlikely-seeming times, for the fragile little Sun-birds in some cases breed in high mountainous parts of South Africa in winter when the snow lies quite deep under their hanging nests.

Besides the direct north and south migrations also, there are cases where the migration is rather from east to west, as in the cases of the White-eyed and Red-crested Pochards (*Nyroca africana* and *Netta rufina*), whose chief winter haunt is in India, though their breeding-range extends not only into Central Asia, but far west into Europe. The Rosy Pastor presents the unusual case of a bird which has a fixed wintering station in the east, and a pronounced westerly migration, but no definite breeding-haunt; for these birds in winter are essentially Indian, but breed in Western Asia and Eastern Europe, but in different places in different years, the flocks, which keep together even in the breeding-season and nest in company,

settling down to breed irregularly in different spots, being guided apparently by the abundance of the locusts, which form a favourite food.

In the East Indies there are curious cases of inter-insular migration in at least two Pigeons, the ground-feeding Nicobar or Hackled Pigeon (*Calœnas nicobarica*) and the arboreal Pied Fruit-Pigeon (*Myristicivora luctuosa*), which wander far and wide in the many islands of the Indian Ocean, but do not come to the mainland. The case of the Nicobar Pigeon is particularly remarkable, as only scattered pairs are found breeding elsewhere than on Batty Malve, a small and fortunately very inaccessible islet in the Nicobar group, which appears to be a perfect Pigeon-house during the season when the birds rear their single chick.

This regular return to isolated spots in huge numbers is almost unique in a land-bird, but, as is well known, quite a common thing among sea-fowl, especially Petrels and Penguins; it was only comparatively recently found out where one of the commonest and most widespread among southern ocean Petrels, the well-known spotted "Cape Pigeon" (*Daption capensis*), nested, the locality being Kerguelen. Wilson's Petrel (*Oceanites oceanicus*) also nests in Kerguelen, and spends the southern winter in the north, affording a rare instance of a southern-breeding bird crossing the equator, though it is quite the usual thing for migrants from north to south to go far south of this line.

It has, indeed, been found that of migratory

groups, the species which go farthest north to breed often winter farthest south, as exemplified among the Swifts and the Turtle-Doves; among Ducks, too, the arctic-breeding Pin-tail and Wigeon go farther south than the temperate-zone-haunting Mallard. None of the Geese, however, which mostly breed in the high north, go very far south.

Many naturalists seem puzzled as to why birds which have escaped starvation by going towards equatorial lands should retrace their course again to the countries they have left; but this is because they have generally little practical acquaintance with any but the birds of the Northern Hemisphere, where only, in Europe and the United States, do ornithologists much abound. To any one who knows the tropics, the problem does not seem so wonderful. In the less well-watered parts of these countries, the heat of the hot season produces effects not so very different from the frosts of the temperate winter. Herbage and leaves are parched up, with the result that both insect and vegetable food become scarce, and the water supply is much restricted. Under these conditions reptiles, frogs, and even fish "æstivate," *i.e.* go in for a summer sleep, in the case of the aquatic creatures burying themselves in the mud, and native birds of aquatic habits have to leave these districts for better-watered ones.

Obviously, then, the migrants are no better off, and have every reason to get out of a country in which the residents have all they can do to survive.

The heat itself may have something to do with making them leave, although on the whole birds from temperate countries or of mountaineering habits seem to bear heat as well as tropical residents, judging from what I was able to observe at the Calcutta Zoo.

This is a most remarkable fact, considering that the very peculiarities of birds I alluded to above as fitting them to withstand cold are just those which ought to make them susceptible to heat; and it is a curious fact that the warmly-clad Duck tribe bear heat, even when migrants from the north, particularly well, while the thinly-clothed Pheasant family are more susceptible than any other birds; the Monaul bears heat worse than any bird I know, panting in a temperature which provokes no such manifestation of oppression from any other bird. Among the Pigeons, too, I noted the Himalayan Snow-Pigeon (*Columba leuconota*) showed no distress at the heat, although a high alpine bird, while some of the warm-climate-dwelling fruit-Pigeons were obviously affected, as were many Parrots. Crows also feel heat much, even tropical species like the Indian House-Crow, and the House-Sparrow, although it lives well through both heat and cold, pants constantly in the Indian summer, while the imported Goldfinch seems quite indifferent to heat.

It is noteworthy, too, that while the Mallard in its wild state does not visit the tropics except on its southern migrations, its descendant, the domestic

Duck, lives and breeds well there, the most specialized of all its breeds, the Penguin Duck—apparently the ancestor of the so-called "Indian" Runner, so deservedly popular nowadays—being characteristic of the Malay Islands, so that, though even in this country young Ducklings are found to be very intolerant of heat, it must have been long and perfectly acclimatized in the East; and many of the migratory Ducks I watched in confinement in Calcutta showed distinct signs of wishing to breed.

On the whole, then, there is little evidence that the direct effect of heat itself has influenced the spring-time ebb of bird-life away from the tropics; but its indirect effects, as hinted above, are another matter, and apropos of this it may be noted that in the Bombay famine of a few years ago the game-birds, which could not migrate, suffered and died just as if they were mammals, while better flyers escaped.

Then there has to be taken into consideration the attitude of the bird-population of the tropics themselves. It is true that this is so numerous and varied that the huge tidal wave of migrants from the north into India makes no more obvious difference to the human observer of the bird population than does the influx of the football crowd into London on the occasion of the great Cup-tie contest to the apparent fulness of the metropolis, and no doubt things are much the same elsewhere.

But birds, like savage tribes and civilized nations, have boundaries to consider, and if they invade the territories of others, must sooner or later have to fight for a place or return whence they came. And in such a contest, which must be inevitable in the tropics when food and favourable locations get at all scarce, the advantage is all on the side of the residents, which are generally speaking birds of a superior type mentally and morally, even when less specialized physically, and perhaps, indeed, on that very account. They generally excel the birds of temperate regions in courage, social instincts, and intelligence, as is shown by their much greater power of combination, and by the far superior nests they often build. Finches of the typical temperate-zone groups have a poor time in an aviary if crowded along with Weavers, and the Tree-Ducks know how to make the migratory temperate-zone Ducks respect them, while the solitary Thrushes would have a poor chance against the Babblers, with their powers of combination which enable them often to resist even Hawks.

There is a popular belief that birds in temperate climates sing better than in the tropics, but all the foundation for this idea is the fact that the Nightingales are birds of the temperate zone, and that some very common Thrushes are good singers; with the exception of the Nightingales no singers of the north of the Old World can surpass, or even equal, the Shama (*Cittocincla macrura*) and Orange-headed Ground-Thrush (*Geocichla citrina*) of India,

and in the New World the Mocking-birds (*Mimus*) are essentially southern, though the most celebrated (*M. polyglottus*) ranges into the northern states. The only point in which the birds of temperate climates really excel the tropical forms is in power of flight, which they have had perforce to cultivate, and even this superiority is not universal, for there are some of the most magnificent flyers among the Parrots and Pigeons, which are essentially tropical to say nothing of Frigate-birds and Tropic-birds.

In addition to influences of this kind, which are operative on young and old birds alike, there is the instinctive attachment to the breeding-place, which is so strong in birds that they have often been recorded as returning to it for many years in succession. This of course must act to a certain extent on the old birds, and even the young, if at all uncomfortable where they find themselves by the time they complete their first year, are most likely to come back to the place which gave them birth, and where they had their first insight into the enjoyments of flight and independence.

The main point about migration, therefore, is the fixing of the methods, not the motive; and it is here that we are confronted with problems difficult to solve. The case of the Homing Pigeon ought to give us some help, but such Pigeons are well known to be guided almost entirely by sight, and to need training by gradually increased stages; whereas birds of passage frequently, perhaps most commonly, fly by night, and, in the autumn migra-

tion, the young often leave the land of their birth before the adults do. A converse case of juvenile independence is that of the common Cuckoo, the old birds leaving us in July, while the young remain till the general southward movement of migrants in September, long after all old Cuckoos have left us.

That many birds have some method of correctly directing their course without the aid of sight is shown not only by the night-flights of many, but by the return of Penguins to their breeding-grounds, unable as they necessarily are to take a wide survey, owing to their flightlessness; by the return of Noddy and Sooty Terns to their breeding-places in the Southern United States after they had been taken away and released hundreds of miles north of their range, and by at least two instances of flying birds taking the correct direction on foot when deprived of the power of flight, that of a Canada Goose recorded by Audubon, and of an Upland Goose cited by Mr. Hudson—though in the latter case it must be admitted that the bird's full-winged mate was with it. These cases are, however, particularly interesting in that in the former the bird's spring destination was north, and in the latter south. In England, also, a cock Reeves's Pheasant, released thirty miles away from home, was found next day perched on the aviary in which he had been bred.

There is undoubtedly a great deal of more or less random movement, especially in young birds;

such are particularly apt to appear in localities not normally frequently by their species, as I found in the case of the invasion of India in the late 'nineties by Baer's White-eyed Pochard (*Nyroca baeri*), most of the specimens I obtained being young birds. Birds also often range for a time north of their breeding-haunts in autumn, and may even fly out into the Atlantic from our coasts, only to perish or come back utterly exhausted.

There is thus a good deal to be said in justification for the statement that young birds " wander almost at random," and that most of them are probably destroyed before the next spring; and the dangers of a long migration may be the chief reason why birds are more numerous, but less fertile, in the tropics, where there is not this wholesale risk to be faced annually. Of course there is a good deal of local movement even in the tropics, but not much is known about this as yet, and the journeys are inevitably far less risky.

It has been pointed out that the reason why day-birds so often migrate by night is that by so doing they utilize hours which would in any case have to be spent without food, and thus economize time and strength; but the ever-present danger of Gulls, Carrion-Hawks, and Crows, some or other of which are always to be found along every coast, all on the alert to note signs of weariness in birds they ordinarily would have no hope of capturing, must surely have something to do with this, and it is to be noted that in all groups the larger or

more powerfully-flying species are more inclined to day migration than the feebler folk; thus, Crows and Swallows among the Passerines, and Geese and Swans among the wildfowl, migrate by day, as do Hawks, Storks, and other powerful and predatory birds.

The tendency to migration is nearly universal among birds of temperate zones; even, as remarked above, in species not usually thought of as migrants, because always visible at any time of year in our country at least; the most thoroughly sedentary of flying birds being the Game-birds and Woodpeckers, which have special facilities for finding food, though even of these some migrate, such as the Quail and Greater Spotted Woodpecker.

On the other hand, there is a strong tendency for migrants to settle down and form non-migratory local races; thus, most of our resident British birds are recognizably different from the continental individuals of the same species which visit us, and are nowadays distinguished as local races or sub-species; and we may notice that the Blackbird shows a much greater tendency to become permanently resident in the north than the Thrush, a weaker and less versatile but more strongly-flying bird. The Quail, one of the most anciently-known migrants, often used to pass the winter here when it was commoner, and conversely has been known to breed in numbers in India, usually only a winter-resort, while it has established resident races in Spain and in the Canaries, although attempts to

introduce it artificially into the United States have failed.

This tendency to settle down and have done with the fatigues and dangers of migration has resulted in the production of many localized and often insular races of birds, which have often become flightless, where flight was of little importance in their daily life; thus we had the Great Auk in the north, formerly a most abundant bird, and in the Galapagos there has been discovered of late years a flightless Cormorant (*Nannopterum harrisi*), and on the elevated Lake Titicaca in the Peruvian Andes there lives a flightless Grebe (*Podicipes micropterus*), such a lake being the biological equivalent of an oceanic island.

Such flightless species are to be found most commonly amongst the Rails, birds which migrate a good deal, but are nevertheless poor flyers as a whole, and always more ready to use their legs than their wings; they also have a most peculiar propensity for turning up in the most out-of-the-way places, being probably unable to make head against a wind, while their power of swimming enables them to rest on the water and gain fresh strength where others would drown.

The widest migrant and most successful bird of all is the little unspecialized Turnstone, which is to be found on all shores in the world at one time or other of the year, and is strongly suspected of having established breeding colonies far and wide in the world, though its main haunts

in the nesting-season are undoubtedly in the north.

When we come to consider groups, however, the palm for success in the struggle for existence, as evidenced by wide distribution over the world, must be awarded to the Terns, a very highly specialized group in structure, exaggerating the points of their more generalized family relations the Gulls. Gulls go nearly everywhere, but are much rarer in or near the Tropics than in colder regions, and rarely breed there, and are absent altogether in the Central Pacific. But you cannot go anywhere without meeting Terns, not only in remote islands, but in the interior of great continents, for there are many freshwater species.

Those curious exaggerations of the Tern type, the Scissor-bills (*Rhynchops*), with the "undershot" beak with which they plough the water for small fish, are all warm-climate birds, but the few species between them extend all round the world.

Although there are no islands too distant for such birds as these—and of course the oceanic Petrels—to have reached, there are some which are too out-of-the-way for any land-bird. When Mr. W. L. Sclater was sent to investigate the birds of the Chagos Islands, a small group in the Indian Ocean, he found no land-bird there except the little Scarlet Weaver (*Foudia madagascariensis*), a most obvious human introduction; and on Easter Island, although a small land-bird has been reported, it has never been brought to book, and

the Tinamous found there have been introduced from Chile.

In Hawaii, too, the Kingfishers and Pigeons and Parrots, which are elsewhere most widely spread in the Pacific, are wanting, though a Chinese Turtle-Dove (*Turtur chinensis*) has been successfully introduced, as also has an Australian Parrakeet, the Mealy Rosella (*Platycercus pallidiceps*), the original stock in the latter case being but a single pair. This being so, it is a great pity that a pair of the common Belted Kingfisher of North America (*Ceryle alcyon*) were shot on arrival, as they might also have found a footing, and this natural introduction of a new form would have been most interesting to watch. The irruption of even a large number of new birds, however, does not necessarily always mean success, as in the case of the failure of the well-known repeated attempts of hordes of Pallas's Sand-Grouse to colonize Western Europe, where they hatched young even with us.

An interesting example of successful emigration, and that by a bird which nowadays very rarely migrates at all, is furnished by the career of the Magpie, a bird whose unique and conspicuous appearance and—where it is not persecuted—its abundance and familiarity, have always made it one of the best known of birds, as the many stories and superstitions relating to it abundantly testify.

It is very doubtful if this bird was known to the ancient Greeks, for no species mentioned in their writings can be definitely identified with it, unless

it was the "Lycian Daw" of Aristotle, which is not described, but merely mentioned by name among other "Daws," in his work on the "History of Animals." The bird the Greeks called *Kissa* or *Kitta*, which some scholars have taken for the Magpie, was evidently the Jay, since Aristotle mentions its characteristic habit of storing away the acorns, and in enumerating the various species of Thrushes compares the Missel-Thrush to it in size, a comparison for which the Magpie would be obviously unsuitable owing to its long tail. The *Pica* of the Romans, from which word the French and English "Pie" is evidently derived, was also the Jay, for here again the acorn-eating habit is mentioned by Pliny, who also speaks of his Pica, as Chaucer, so many centuries later, mentions the Jay, as a bird kept for talking. The Roman naturalist also gives us a definite clue to the extension of the Magpie's range in his time, for he says that of late years a new sort of Pie (*Pica*) had appeared in the neighbourhood of Rome, noticeable for its varied (or pied) colouring and long tail.

Many centuries later we have a definite historical record of another westerly irruption of Magpies, when about the year 1676 a flock of about a dozen is stated to have arrived in Wexford—the ancestors of the numerous Magpies which now form so noticeable a feature in the bird-life of Ireland. That they did not inhabit that island previously is known from the "Itinerary" of Fynes Morison, who expressly notices their absence in 1617.

As the Magpie is found in Western America and all along the width of Asia in the north, it would seem as if it were originally an American bird which has in the course of thousands of years been moving continually westwards, although on the other hand the American birds may be a colony which crossed Bering Straits in the opposite direction to found a colony in the New World, as the Alaska Wheatears are doing, in which case we might look to Central Asia as the cradle of the Magpie race; it stands so much alone in the Crow tribe that it has no near relatives to give us a clue.

CHAPTER VIII

The senses of birds—Sight and its general high development—Degree of perception of colour—Influence of colour, if any, on courtship, and the segregation of species—Perception of the colour in various kinds of food—Smell, usually poorly developed—Exceptions noted—Acuteness of hearing—Sense of touch—Taste-perceptions.

The senses of birds are nearly all well developed, though the mechanism of the sense-organs is sometimes much less elaborate than in the case of mammals, an important instance of the want of correlation of structure with function. In power of sight they, as a rule, surpass all other animals, this being the dominant sense in all birds except the Apteryxes or Kiwis of New Zealand, which see very badly, not only in the day, when they are naturally at rest, but even at night, when they will walk right up to a person when at large, and show no alarm when a white handkerchief is waved at them when in captivity.

There is a possibility that there are great differences in the powers of distant sight of ordinary birds, but there is little or no evidence so far on this head. Macgillivray has indeed suggested in his book on British Birds that the Sparrow-Hawk is

short-sighted, because he had observed it does not seem to see birds in a hedge at a hundred yards' distance, and does not attack except at a range of a few yards. The obvious criticism on this, however, is that the Sparrow-Hawk, like other birds of prey, does not waste time and strength in attempting attacks which have no reasonable prospect of success; its strategy is mainly one of surprises, for though capable of very great speed for a short dash, it is not suited for a long pursuit. It therefore pays no attention to birds which it does not consider favourably placed for attack.

I have seen behaviour in Kites in Calcutta which exactly suggests this. The Kite has no speed at all, but can execute a very successful surprise stoop, snatching food even from a man in a most disconcerting manner. I have seen one of these birds, passing with the slow flapping flight which it employs when travelling at a low elevation of about the height of the house-tops, evidently meditating an attack on a Dabchick and her young on the Calcutta Museum tank. The thought in the Kite's mind was obvious, as it hung on its wings for a moment over the little group; but "chip, chip," went the Dabchick—which ordinarily never bothered about Kites—beginning to "go down by the bows" in preparation for a dive, her downy young imitating her, evidently reading the enemy's intentions; and the enemy's comprehension of the hopelessness of the situation was equally complete, for the poising was but momentary, and the Kite flapped

on again, knowing that before its stoop could reach the water the quarry would be under it.

Only occasionally were such very faint attempts made, the numerous Kites knowing full well the uselessness of attack, and this no doubt explains why they never carried off the sitting Dabchick or her young when resting on the very exposed nest. One I bought in the bazaar and threw up near the pond, failing to get under way and falling to the ground, was instantly snapped up by a Kite within a few feet of me. A dead Sparrow was also instantly picked up, though live ones were not chased; yet a released cage-bird, if at all weak on the wing, was instantly pursued.

The sight of the high-soaring birds of prey is supposed to be particularly fine, and certainly Vultures seem to be able to perceive a dead animal when themselves out of human sight, though of course they are often guided to their prey by observing the movements of others floating at a lower elevation, or of lesser scavengers such as Kites and Crows, flying near the earth.

In this connection it is interesting to note that the eyes of most Vultures are small compared to those of Eagles, and are not overhung by a bony brow, perhaps because less exact observation is necessary in their case; but in the ordinary way, size of eye seems to have no more to do with power of vision in birds than in man, the usually small-eyed Ducks and Geese being to all appearance quite as quick-sighted as any other birds. Nor does

there seem to be any connection between colour of iris and visual powers, both Owls and Hawks, for instance, being found with either dark or yellow eyes; this is, of course, not surprising, as the iris itself plays no direct part in vision, but some correlation might have conceivably existed.

That some birds have powers of sight surpassing those of man is known from the use of the Great Grey Shrike by the Hawk-catchers at Valkenswaard in Holland, who are informed by their tethered Shrike of the appearance of a bird of prey before they could see it themselves, and when nearer, of its character, whether Harrier or Buzzard on the one hand, or Falcon or Goshawk, by the degree of agitation shown by the sentinel.

The Indian Roller (*Coracias indica*), too, sitting lazily on a telegraph wire in the glare of the Indian sun, perceives and flies down to an insect or other small prey at a distance at which human eyes would certainly not perceive such an object; while many must have wondered how a Kingfisher, or even more a Gannet, discovers a fish and is able to judge its distance from the surface sufficiently well to make a successful swoop. It must be admitted, however, that the Kingfisher at all events makes at least as many misses as hits, not having so much judgment as some of the birds of prey I have been mentioning; and, speaking of most birds, they do not behave as if their power of sight were any better than our own.

Diving-birds, however, may enjoy better sight

under water than we do ; at any rate it is interesting to note that just as we use a water-glass to examine the bottom, so do Grebes and Cormorants often put their head under water to beyond the eyes before diving to get a clear view. These hunters under water can, however, generally see as well in the air as any ordinary birds ; in fact, those I have mentioned, and such diving-ducks as Golden-eye and Mergansers, are notoriously very wary and alert birds. Penguins, however, are suspected of being short-sighted when out of water.

The powers of night vision which Owls and Nightjars possess, also, do not seem to interfere with their vision by day, the idea that they are dazzled by daylight being solely due to the fact that they are unwilling to move in the day. When they are actually on the wing, they fly well enough and avoid dangers and obstacles quite successfully, and in captivity they show interest in birds flying over, and even bask in the sun. In the case of Owls, the curious peering movements of the head certainly give the idea of bad sight, but these gestures are indulged in just as much in the dusk of the evening as in daylight, being merely a trick of habit ; indeed, something similar is seen in the more jerky head-movements of the Hawks.

The blinking of the upper eyelid in Owls is also a very human action which may have helped to suggest the idea of blindness in daylight, almost all other birds winking with the inner or third eyelid, which is drawn so rapidly across the eye

that it does not interfere with the gaze, and is hardly noticed by the onlooker. The Dipper, or Water-Ouzel, also blinks the upper eyelid like an Owl; the reason of this seems obscure, since other birds that hunt under water do not do so.

Nor, as far as that goes, do all Owls hunt at night; many, such as the Snow Owl, Hawk-Owl, Short-eared Owl, and Burrowing Owl and some others, hunting either by day or by night, while the Little Owl and Indian Little Owl (*Athene noctua* and *A. brama*) come out while it is still daylight; in India I used to notice the latter out at about five o'clock in Dehra Dun, while in Calcutta they did not show themselves till nightfall, no doubt owing to the hostility of the numerous Crows, for I have seen a homing Crow swoop at an Owl which had appeared a little too soon.

There are also some Nightjars which hunt by day, such as the American Night-Hawk (*Chordeiles popetue*), which is often abroad high in the air in bright sunlight. Woodcocks and Snipe, which are usually night-birds, may also feed by day.

Conversely, many of the birds which have no special adaptation for night vision often fly and feed at night, such as many members of the Duck and Plover tribes, especially the common Lapwing and Mandarin Duck, whose unusually large eyes may, however, be an adaptation to these habits. Certainly the last-named bird, in spite of his gay colours—such being almost unknown in true nocturnal birds, which are sombre like mammals—is,

judging from its habits in England, quite as nocturnal as some of the Owls, not stirring much before noon, while the trampled ground in any small enclosure in which specimens are kept shows that they run about much at night.

Most Ducks, when free from human persecution, are certainly inclined to diurnal habits to a greater extent than their behaviour where sought by sportsmen would indicate, and M. Rogeron says that their night-vision appears to be no better than our own, judging from the way in which they will fail to see bread thrown to them at dusk. But as they generally fly in the open and feed much by feeling, this is no great drawback.

The ordinary day-birds certainly are just about as much at a loss at night as we are, and can avoid danger just about as much. Game-birds are generally particularly helpless at night, as we see in the case of Fowls and Pheasants; but Peafowl are far more alert—I have known a Peahen which had escaped from the former trading menagerie at Covent Garden remain at large for months, in spite of attempts at nocturnal surprises. The Quail appears to be even actually semi-nocturnal, for in captivity it freely moves about at night; one I kept loose in a room was quite quiescent by day. The Lineated Pheasant of Burma (*Gennæus lineatus*) has also been observed coming out into forest clearings on moonlight nights.

Although Parrots are mostly diurnal birds, there are some as nocturnal as Owls, such as the great

flightless Owl-Parrot or Kakapo of New Zealand (*Stringops habroptilus*), and the small, flying, but otherwise very similar Night-Parrakeet of Australia (*Geopsittacus occidentalis*); and the sheep-killing Kea seems to be active indifferently by day or by night, which is one reason why its attacks on the sheep are so hard to guard against.

Lord Tavistock has also noted recently that an Australian Black Cockatoo which he had flying loose about the park at Woburn was often on the wing after dark, though of course mere flying after dark does not necessarily indicate nocturnal habits, as so many migratory day-birds fly at night. The New Zealand flightless Rails or Wekas (*Ocydromus*) are active by night as well as by day, and ordinary Rails are great night-fliers. Swifts are said often in hot weather to soar up and stay aloft all night.

Herons often move and feed either by day or night, and Bitterns and Night-Herons (*Nycticorax*) are true nocturnal birds; I noticed, however, that in our colony of the common Night-Heron (*N. griseus*) at Calcutta, the birds did not seem to sleep much during the day; but the same thing can be said of most Owls, only the Barn-Owls being generally really asleep in the daytime, if one may judge from their behaviour in captivity. Petrels are nocturnal at their breeding-places, probably from fear of Gulls and Crows, for out at sea one sees them flying freely by day in the hottest sun; I have even seen a Storm-Petrel and a Clouded Yellow butterfly flying within a few yards of each other.

Just as Macgillivray suggested the Sparrow-Hawk was short-sighted, so Professor Newton, in his "Dictionary of Birds," remarks, with reference to the easy-going way in which the Hedge-Sparrow accepts an alien egg, that for all we know to the contrary it may be colour-blind; and within the last few years, a fancier writing to the *Feathered World* about Homing Pigeons has said that though they can distinguish black from white, this is not the case with colours.

The possibility of some birds not seeing as we do must therefore be borne in mind, but as regards the class as a whole the general evidence certainly tends to bear out the commonly accepted idea that their vision for colour is the same as our own. This is shown in several ways; for instance, they recognize colour in other birds, and display either friendship or hostility in consequence, according to whether they are at the time in need of companionship or in a position to feel jealousy. Birds which are normally spiteful, for instance, are likely to attack a species which bear colours reminiscent of their own; thus Jenner Weir told Darwin of a case in which a Robin in an aviary killed a red-breasted Crossbill and injured a Goldfinch; and an American Indigo-bird (*Cyanospiza cyanea*) attacked a Nonpareil (*C. ciris*), which has a blue head, and nearly scalped it. I have myself seen a mated Blue Australian Wren (*Malurus cyaneus*) in one of the Zoo aviaries furiously pursue a cock Yellow-winged Blue Sugar-bird (*Cœreba cyanea*),

which it certainly would have hunted to death had not the keeper removed it; and the Green Cardinal (*Gubernatrix cristata*) has a bad name among fanciers for spitefulness to birds of similar colours.

I have above commented (Chapter V) on the alarm shown by birds at the sight of young Cuckoos, though it may well be pleaded that as the pattern is the striking point here, the evidence is not necessarily in favour of colour-vision; nor need colour-vision to be postulated to account for terror which the mixed birds in the Western Aviary at the Zoo have shown in my presence at the Grey Touracou (*Schizorhis concolor*), or the Parrots in the large Parrot Aviary at the dark-slate Vasa Parrot (*Coracopsis vasa*), both birds of coloration which, although uniform, is met with in some birds of prey.

I have witnessed sympathetic attraction of colour, or at any rate markings, when in Calcutta I turned a specimen of the Silver-eared Mesia (*Mesia argentauris*) into a large flight-cage with a mixed collection, and saw that it at first associated with the Black-capped Sibia (*Malacias capistratis*) and White-eared Bulbul (*Molpastes leucotis*), before finding out its really near relative, the Pekin Robin.

The House-Crows in Calcutta used to get very excited when they saw a live or dead bird handled which showed much black or dark colour, using the same cries and gestures as they employed when seeing one of their own kind handled; I have seen this when the subject was a Muscovy Duck, a

cock Amherst Pheasant, and even a Drongo-Shrike, the sworn enemy of Crows. Here there is a case of sympathy aroused by colour, but as in the above case, no proof of perception of anything but light and dark shades.

The old cock-fighters used to object to a hen-feathered cock in the pit, owing to the fact that the opponent of such a bird was likely to mistake it for a hen, and so allow it an advantage while courting it; this might argue a perception of colour on the part of the Fowls, as the distinctive ornaments of the cock—large comb, long hackles and sickles—were shorn before the fight, so that only the colour would be left to differentiate between the sexes. But it must be remembered that the pattern of cocks and hens is also generally very different, the upper and under surfaces of the former sex presenting marked differences in all except uniformly coloured varieties, which were rather rare in the pit game-fowl.

The preying relations of birds to warningly coloured insects, to which I devoted much attention in a long series of experiments made during my residence in India, and published in the *Journal of the Asiatic Society of Bengal*, showed, in my opinion, distinct colour-perceptions in the species I employed for experiment, since these generally preferred more plainly coloured butterflies to the "warningly coloured" Danaids (*Danais chrysippus*, *genutia*, and *limniace*, and *Euplœa core*), and the still more striking "warningly coloured" white

Delias eucharis and swallow-tail *Papilio aristolochiæ*, and of these only the two first species of *Danais* mentioned were at all like each other in colour, though I must admit that they could all have been distinguished by pattern also.

The common Babblers I worked with appeared to be deceived by the resemblance of the female *Nepheronia hippia* to *Danais limniace*, though this is not very exact; and two species of Drongo Shrike by the resemblance between the swallow-tail above mentioned and the mimicking form of another species (*P. demoleus*) which is extraordinarily like the very unpalatable *aristolochiæ* except in having the abdomen black like most of the wings, instead of scarlet like the spots on the hinder pair of these, a distinction which was not so conspicuous in life as it sounds in print. The intelligent little Pekin Robin, however, was not to be deceived by this very close mimic, but it was taken in by the extraordinarily perfect resemblance of the female *Hypolimnas misippus* to *Danais chrysippus*, a resemblance which is one of the "show horses" of the theory of warning coloration and mimicry, and usually deceives human entomologists if unprepared for it.

Speaking of birds' mistakes, I once saw a very amusing one made by a cock Sparrow in Calcutta, which flew down and picked up what he evidently mistook for a beetle, the creature really being a very small specimen of the local toad (*Bufo melanostictus*); and from the movements of his bill after

he had, immediately, dropped it, he certainly would have "pulled a face" had his features admitted of it. Such an instance enables one to see how very advantageous the acquisition of "warning colours" might be to a nauseous animal, saving it from some experimental tasting; but unfortunately for the theory, toads, and several other animals with repellent attributes, have been singularly unsuccessful in evolving such patterns.

The mere possession of a striking pattern of the conventional "warning" type does not prevent experimental tasting by novices; my birds often tried an insect they afterwards refused, and a very interesting case of this occurred with a Starling (*Sturnus vulgaris menzbieri*), which is only a winter migrant to India, and probably knows little of the taste of Indian butterflies. I offered this bird one of the black-and-scarlet swallow-tails above-mentioned, which was immediately gulped whole with characteristic Starling greediness. But next day another was not even touched, at which I was not surprised, as this butterfly is so objectionable to birds that often they will not even kill it.

So the lesson was well learnt, and such lessons may be long remembered; to a Starling I kept in England, which, when I bought it, had been kept for months in close captivity, and had had no chance of seeing caterpillars, I offered those of the buff-tip moth (*Pygæra bucephala*), well known to be unpalatable to birds, and distinguished by a striking black-and-yellow chequered coloration; the bird

simply turned them over with its bill in search of something better beneath, as if they had been so many ends of string or bits of stick, while when I had offered it a much larger green caterpillar on a twig it ravenously tore it from its hold and devoured it.

This experiment, by the way, wants repeating under circumstances fairer to the caterpillar, though as a matter of fact I was not trying to find out if the bird would miss the insect owing to its protective coloration, as I have once seen a green lizard do. That is to say, if the power of a bird to see through a protective disguise is to be tested, the insects should be *in situ* beforehand in a place to which the bird is admitted without having been allowed to see the preparations and so have its expectations raised. Until it is experimentally proved that birds overlook insects of protective appearance in their natural environment, we are not justified in saying that such appearance is of any survival value as far as feathered enemies are concerned.

In the case of birds of prey there happens to be some evidence of the value of protective resemblance; a tame Peregrine Falcon flown at a Houbara Bustard (*Houbara undulata*) has been seen, when the quarry had settled and squatted, to alight and search all round on foot without success, and Lloyd, an excellent observer, says in his "Wild Sports in Sweden" that the Swedes when trapping for Hawks use a light Fowl, Pigeon, or what not for bait in ordinary weather, but a dark one if

snow is on the ground. Moreover, Mr. J. G. Millais in his "Breath from the Veldt" describes how the Bateleur Eagle (*Helotarsus ecaudatus*) often captures prey owing to its habit of scanning the ground behind as well as before it as it soars, other Eagles passing straight on and missing prey which has squatted on their approach, only to get up and move directly they have passed.

In all these cases, however, we must remember that immobility may be a more important factor than colour. With regard to the fruit food of birds, it is to be noted that they eat red currants sooner than the white variety of that fruit, but colour may not decide this.

Whatever attention birds pay to the colour and pattern of their prey or foes, they seem singularly inattentive to it as regards recognizing their own racial affinities, for the theory of recognition-marks, which supposes that species of birds which are closely alike except for colour and pattern are aided in selecting partners by such differences, is not borne out by facts. Whenever the difference between two forms is so slight that colour, not structure or note, is the only distinction, the birds themselves disregard it, no matter how glaring the difference may be.

This is best known in the case of the Hooded Crow and Carrion Crow (*Corvus cornix* and *C. corone*) in the case of our own fauna; these birds seldom breed in the same district, but when they do they frequently cross, and the same is the case with these

species where they meet in their breeding-range outside Britain, as in Central Siberia. Here also our Goldfinch breeds and interbreeds with the Grey-headed Goldfinch of the Himalayas (*Carduelis caniceps*), a bird provided with excellent recognition marks. Actual specimens illustrating these points can be seen in the Entrance Hall at the South Kensington Museum.

American naturalists will recall the case of the Red-shafted and Yellow-shafted Flickers (*Colaptes cafer* and *C. auratus*), two inter-breeding Woodpeckers also well distinguished by hues and patterns, and Anglo-Indians that of the Indian and Burmese Rollers or "Blue-jays" (*Coracias indica* and *C. affinis*), the latter much darker than the former, and devoid of its conspicuous terminal tail-bar, yet producing numerous intergrades, while the pure forms, as in the case of the Crows, have actually been seen paired up together.

Many similar cases might be cited; in fact, just where "recognition-marks" might be expected to be of service, there they uniformly prove inoperative to segregate species—as might indeed have been expected when we see our variable domestic birds infallibly recognize their own species in spite of abnormalities in colour.

Neither does the study of the courtship of birds exhibiting colour-variations encourage the idea of preference for a particular type of colour. Sir Ralph Heron recorded, nearly a century ago, how all his Peahens fell in love with a pied Peacock, and

Mr. D. Dewar has observed that white Peacocks in the Lahore Zoo had superior charms to the coloured birds; while I have seen London park Mallard Ducks not only pair with all-white, grey-breasted, and rufous-flanked drakes in preference to the typical male in its full beauty of colouring, but in one case recently even with a Spotted-bill Drake (*Anas pœcilorhyncha*), which has no distinctive male plumage at all. M. Rogeron also says that this Indian species, the African Yellow-bill (*A. undulata*) and Australian Wild Duck (*A. superciliosa*), none of which have any distinct sex-coloration, nevertheless interbreed with Mallard as if all were of one species.

Recently I saw at Kew a Mandarin Drake whose left eye had been destroyed, and whose face on that side was abnormally white, paired with a fine unpinioned female, in spite of the presence of perfect drakes, one at least unpinioned, which I saw her charge with tail wagging defiantly, instead of inciting her mate to do it, as is commonly done by this most affectionate and selective species. Another bird at the Zoo with misplaced wing, spoiling his colour-scheme entirely, also has had a mate for years, though Mandarin Ducks, like Mallard, will tolerate bigamy rather than take to a drake they dislike. I have, however, seen a case in the Calcutta Zoo in which a Mandarin Drake of superior plumage was preferred by the ducks to others, though these were not positively defective; and I have found also in Calcutta a Linnet hen prefer a lame male with a

richer-coloured breast to a poorer-hued but perfect bird, and a hen Avadavat (*Estrelda amandava*) prefer in two cases a bright to a duller-coloured male.

If birds have the æsthetic sense with which Darwin credited them, they may, like us, think more of small differences than large ones; golden hair is generally admired by man, but no good judge would put it, as a point of beauty, above well-chiselled features, though it catches the eye more at first. As against the possibility of birds generally being colour-blind, we may perhaps set the preference of the Australian Satin Bower-bird (*Ptilonorhynchus holosericeus*) for blue when choosing decorations for its bower, and the liking of some Weaver-birds for green and yellow wool when given this substance to amuse themselves with in a cage. It will be noted that yellow is a common colour among Weavers, and that the eyes of the above-mentioned Bower-bird are blue, a very rare colour in live birds' eyes, though taxidermists are fond of it in glass ones!

Before leaving the subject of the sense of sight in birds, attention must be drawn to its extraordinary acuteness in Humming-birds, which, as I have been able to observe in the case of captive birds, appear to be able to see glass; at any rate they do not fly against it as other birds constantly do.

The sense of smell in birds seems to be little developed as a rule, not more than in ourselves, at all events judging by their behaviour.

The Apteryxes, however, are exceptions, as these birds, which unlike all others have the nostrils at the tip of the beak, nose their way about like a beast, even sniffing audibly. Some sportsmen also are of opinion that wildfowl have a keen scent, and should be approached accordingly with due regard to the direction of the wind, as in stalking deer and other similar animals; and decoymen used to burn a turf before their mouths when working a decoy, so as to hide the human scent. St. John also recorded that his domesticated wild Ducks scented out a heap of diseased potatoes which had been well covered with earth. On the other hand, Mr. Millais found that wild Geese approached quite near him when concealed in a pit, so as to suggest they had no particular power of scent.

The sense may be well developed in the Crows, for M. Rogeron says a pet Jackdaw of his could distinguish between salt and powdered sugar, which nevertheless were alike to the eye, taking only a few grains of the one substance and a big beakful of the other, and Dickens describes how his second tame Raven disinterred the halfpence and bits of cheese his predecessor had buried in the garden. Pigeons also used at any rate to be credited by fanciers with liking the smell of aniseed, which was supposed to attach them to a cote.

The only case in which I myself have seen anything which suggested scenting power in a bird was that of a Pied Hornbill (*Anthracoceros malabaricus*) I kept in India, which, when offered

butterflies, refused the Danaids after pinching them with the tip of the bill, and treated a cigar-end in the same way. The latter substance might have been rejected by touch, but in the case of the insects, as the bird ate other butterflies, it seems only natural to conclude that it detected an objectionable scent by means of the posterior nares; taste was out of the question, as the tongue in the Hornbills is so very short, and the beak, for some inches from the tip, as dry and horny inside as out.

With regard to the very birds in which one would expect scenting powers to be particularly well developed, the Vultures, all the evidence is against this, those who have experience unanimously declaring that a carcase if well covered over is not detected by them; and in Darwin's classical experiment with a hungry Condor the bird did not appreciate the nature of the contents of a paper parcel of fresh meat till he touched it with his beak, in which close proximity the odour of raw flesh would no doubt be detected by a human nose.

In spite of the less elaborate structure of the internal ear, and of the absence of an external one altogether, there is no doubt that the hearing of birds is at least as good as our own, and in many cases possibly even better. This is particularly remarkable, because not only is the outer ear or auricle wanting, but the ear-hole itself is generally overhung by a dense patch of short and very firmly rooted feathers, the ear-coverts, which sometimes remain when the rest of the head is naked, as in the

Sarus and Australian Cranes (*Antigone collaris* and *A. australasiana*). In most bald birds, however, the ear-hole is exposed, as in the Ostrich and Turkey, and so it is, curiously enough, in an Australian bird with otherwise feathered head, the Mallee-hen (*Leipoa ocellata*).

The perfection of birds' hearing may be accurately judged of by the performances of the various talking and mimicking birds, such as Parrots and Mynahs, whose imitation of their models is often absolutely perfect; and the susceptibility to sound of species which have not these vocal gifts is well known.

It is said that the wild Turkey, when being lured within shot by an imitation of the hen's call, will at once detect a false note, and be shy for the rest of the season; and the Canadian Goose distinguishes at once, according to Audubon, between man-made sounds and the natural ones of the woods and wilds, the crack of a dry stick under a deer's hoof being discriminated from its breakage by a human foot, and the accidental slap of a paddle against a canoe-side from the flop of a Turtle taking to the water.

Every one also is familiar with the Roman Geese whose vigilance is said to have saved the Capitol; and whatever the historical value of the human part of that portion of Roman history, no goose-breeder, says Fowler, as quoted in Wright's "Book of Poultry," would at all doubt it, his own experience corroborating it in every essential point. The Roman poet's attribution of greater sagacity to

Geese than to Dogs is also borne out by a correspondent of Hewitt's quoted in the same work, who characterized Spanish (Chinese) Geese and Guinea-Fowls, kept in a lonely place, as the best watch-dogs in the neighbourhood, the actual dogs themselves generally only giving the *second* warning, so that it was thought they themselves relied on the birds. The Peacock is also not inferior to the Guinea-Fowl in wariness at night, and probably also relies on hearing; a few Pea-fowl in game-coverts might prove an excellent and inexpensive guard against poachers.

It has recently been noted in the press, too, that Parrots kept in fortresses and on the Eiffel Tower during the war gave warning of approaching aeroplanes when they could not possibly have seen them, and two writers, one who kept a Sulphur-crested Cockatoo and the other a Ring-necked Parrakeet, have recorded, the former in "Notes on Cage-birds" and the latter in the *Avicultural Magazine*, that the birds became aware of their masters' arrival at home at a distance at which any hearing seemed impossible. Even the Kiwi will jump if one claps one's hands suddenly close to it at night, though the waving of a white handkerchief fails to impress its dull sight.

The sense of hearing is much more important in determining the relations of birds to each other than is generally supposed, and appears to be more important than sight. Thus, the freely interbreeding species which have been above

commented on resemble each other in voice, even when this differs greatly in the two sexes, as in the Ducks of the genus *Anas* mentioned, and birds at once recognize and respond to a sufficiently accurate reproduction of their call, as all field-naturalists are well aware. Thus, I have made both a wild jungle-cock and tame roosters answer me, though I am unable to imitate more delicate notes, and have made wild Duck circle round and lower their flight by quacking to them. People who do not want vicious cocks, by the way, should carefully refrain from mocking their birds thus, as when the fowl's brain has grasped the location of the challenge in the human, he will attack, and remain permanently spiteful, in which case he is dangerous to small children.

Different species—too far apart to readily interbreed—will associate if the note is similar, as in the case of the Whistling Tree-Ducks (*Dendrocycna*), when specimens find themselves isolated in captivity, different though they may be in colour. But allied species have a wonderful knack of knowing each other by sight, even if colour and voice are both different; thus, the Mandarin and Carolina drakes not only occasionally make love to each other's females, which is not surprising, as these are so much alike that one generally has to look at them twice to see which is which, but the females will reciprocate, although the two male birds are very distinct both in coloration, decorative plumage, and voice.

I was much amused on a most miserable Sunday one January to see a very agitated Mandarin Duck which had got left out in the pairing which was going on despite the cold rain, establishing an understanding with an equally forlorn Carolina drake, in spite of differences of language. Her gestures made it clear to him that she wanted him to drive off Mandarin drakes who happened to pass, and I saw him get two duckings from these while I watched, although she was quite ready herself to follow any mated Mandarin till he turned to drive her off.

The note of the male of her species certainly seems to have a very potent effect on the hen at times; twice I have seen the common Starling fly to her mate when singing, and pairing take place, the only occasions on which I have observed this, and possibly the "instrumental music" practised by some birds may have charms to soothe the feminine breast. On the only occasion on which I ever saw the pairing of the Green Peafowl (*Pavo muticus*), the hen signified her assent just after he had rustled his train for the second time, although on the first rustling, after she had apparently been admiring his display with unusual attention, she slipped round behind him, only to come forward again.

At such times both this and the common Peafowl utter a long-drawn and peculiarly shrill scream, quite unlike their usual call, and this may have its effect on the hen. I have also seen the common

Collared Dove stoop to her mate when he was cooing, and the House-Mynah in India similarly respond to the chattering song and bowing movements of the male, though I have also seen her turn on him for displaying, like the hen Sparrow.

In spite of their powers of hearing being similar in character to our own, and their voices often pleasing us, birds have no taste in music, as we understand it, though we must also remember that savage or primitive music does not appeal to us, nor do we as adults enjoy the horrible noises, such as slate-pencils "scrooped" on slates, which seem to please children.

But it is at least curious that birds are so wilfully perverse, as we should call it, in their selection of sounds to respond to and imitate; a Canary can be got to sing in answer to the working of a sewing-machine or the fizzling of a frying-pan, and will often spoil its song by the interpolation of a Sparrow's chatter; while the various mocking species of birds, such as the true Mocking-bird of North America (*Mimus polyglottus*) and the Shama of India (*Cittocincla macrura*) persistently degrade their beautiful songs by imitating harsh cries. I have also heard the Indian Orange-headed Ground-Thrush (*Geocichla citrina*), a species which combines the excellences of the Song-Thrush and Blackbird, irritatingly repeat a most trivial and monotonous note it had picked up in the Zoo aviaries.

Some birds seem to be able to hear notes inaudible to us; thus, the Starling when singing

frequently opens and shuts its bill without producing a sound that I can hear, at any rate, but no doubt the hen hears it; and some of the little Eastern Weaver-Finches known as Nuns or Mannipais (*Munia*), go through all the gestures of singing while emitting scarcely any noise audible to us but a faint mew at the finish. As the hens listen very attentively, they no doubt can hear, and evidently like the music, such as it is, though even to them it cannot sound very loud, judging from their close attention.

The sense of touch in birds is certainly not facilitated by their structure—generally horny beaks and scale-cased feet, and feather-covered body; but it is reasonably acute nevertheless. In Ducks, in which the beak is covered, except at the tip and edges, with skin instead of horn, it is no doubt more acute than in most, and the common Sheldrake has the expanded edges of the beak near the tip so soft that it can fairly be said to have lips, while in the Australian Pink-eyed Duck (*Malacorhynchus membranaceus*) these lips are quite large and hang down like the flews of a hound, so that the beak should have much tactile sensibility.

In Snipe and Woodcock, also, the bill is quite soft at the tip, and these birds, like Ducks, feed by feeling in mud; but hard-billed waders like Storks also grope in mud with much success, and many of these birds also feel in the mud with their feet, though this, like the scratching action often per-

formed by Ducks in the water, has no doubt for its primary object the loosening of the bottom to stir up lurking prey.

The cere, or soft skin at the base of the beak in Parrots, birds of prey, and Pigeons, may have some tactile value, preventing these birds from plunging the beak over the nostrils in the soft food, flesh or fruit, on which so many of these birds subsist; at any rate, the only other groups in which the beak has a soft covering are the Ducks and Flamingoes, in which only the end and edges, as has been said, are horny, and these are habitually mud-feeders, and seek food by feeling. The soft flanges or lips, at the base of the bill in the nestlings of Passerines, Hoopoes, and Woodpeckers, are also sensitive to touch, and no doubt aid the young "yellow-beak" to perceive the food the parents offer it; but they are not found in other young birds even of the helpless kinds, and never in active chicks.

Whiskers like those of many mammals are found round the face and base of the bill in the Apteryx or Kiwi, so beast-like in its behaviour, and presumably they may serve as feeling-organs in the same way; but it is less easy to divine the use of the bristles found at the sides of the beak, and often where it joins the forehead, in many birds which feed on flying insects, and specially conspicuous in the Nightjars and Flycatchers. They may act as guides for the snap of the beak, but they are absent in many birds of somewhat similar habits

to those which possess them; for instance, the Nightjars of the genus *Chordeiles* have none, nor do the Swallows or Swallow-Shrikes exhibit them. Yet they are particularly well developed in the Barbets of the genus *Xantholæma*, of which the Coppersmith (*X. hæmatocephala*) is a conspicuous example well known to Anglo-Indians, and these are chiefly fruitarians, while the more omnivorous Barbets of South America have bristleless mouths.

The feet of birds seem fairly sensitive to pain—at any rate they nurse a hurt foot by holding it up; but generally speaking they are, like the lower animals generally, very indifferent to injury. Ducks, for instance, after being pinioned and released into the water, do not look at the mutilated member, but throw water over themselves as usual after being handled, and may even begin feeding—in the case of Tree-Ducks, which are far less nervous than Ducks generally.

I do not, however, think this justifies the operation, as I consider mutilating a bird for life to save the trouble and supervision required to clip its wing annually is slovenly management, and no person who will not take trouble over them is justified in keeping birds at all, especially as the birds which are kept under restraint by pinioning them are exactly those which are not maintained for practical purposes; the operation would be pardonable if needed to be applied to poultry, for instance.

With regard to the taste-perceptions of birds, there are some puzzling problems. They often

are able to determine the taste of an insect, for instance, by taking it up in the tip of their beak, but sometimes, as in the case of the Starling above quoted, do not seem to know whether they will like such an object or not till they have actually swallowed it; in this case the sensation, satisfactory or otherwise, must be determined by the stomach. I have seen a toad swallowed and rejected by two large Gulls in succession, and then tried by a third, which after retaining it a while, threw it up and looked at it, but swallowed it again on seeing another coming to investigate, and retained it as long as I watched.

Here the process of killing and swallowing by the first experimenters had evidently eliminated most of the toad's poisonous skin-secretion, but left a distinct power of causing disturbance of a kind; and after all we ourselves do not know in the case of many articles of food if they will "agree with us" till after eating. Birds after tasting something they dislike will often vigorously wipe their beaks, and this is a good sign to follow, if it be borne in mind that wiping the beak may occur under other circumstances.

In the case of dry grain, etc., which is swallowed whole, as by Pigeons and Game-birds, all pleasurable sensation must of course be stomachic, and this must be great to induce birds to swallow with pleasure such substances as acorns, and monkey-nuts in the husk, so beloved by Wood-Pigeons. The birds in this case seem to come at an idea of

the edibility of an object by weighing it in their beaks, and are often slow in taking to a new food, as when beans are given to Pigeons, and white peas to Fowls.

Generally speaking, the tastes of birds are not so very unlike our own, having regard to the immense variety of human tastes; the Peregrine Falcon, for instance, though it will eat Rooks and Gulls, much prefers Ducks, Grouse, and Pigeons; and I found the whitebeam berries which the birds so much appreciated had a mealy, satisfying taste, like mashed potatoes—the sort of thing one does not get tired of. Yet on the other hand, birds eagerly eat the sour, bitter berries of the mountain-ash, though even these are made by some people into jelly.

Both wild and captive birds readily take to many of the standard articles of human food, even though not suffering actual hunger, as every one may see in the fondness for bread they so often exhibit; sugar, too, is often greatly relished; I have seen Sparrows eat it in the powdered state in my rooms in Calcutta, and carry it off by the lump at the Crystal Palace.

A more curious taste is that for milk, which appeals to a great variety of birds, and makes one wonder if the Nightjar's classical reputation as a goat-sucker, and the Zulu rendering of its cry "Milk for your people," is such a fable after all, its mouth certainly being big enough to perform the feat!

CHAPTER IX

The emotions of birds—Mentality higher than is supposed, but variable according to species or groups—Strong- and weak-minded birds—Intelligence and stupidity—The limitations of instinct—Expression of the emotions and its relation to courting displays—Love and sociability—Hatred and revenge—The police instinct—Monogamy, polygamy, and polyandry—The problem of preferential mating.

THE facts detailed in the last chapter seem to indicate that most birds have much the same sense-facilities for acquiring a knowledge of the outside world that we ourselves possess, and so it is not surprising that they are, as far as we can make out at present, as much like us in mind and emotions as we can expect any of the lower animals to be. One might in fact expect them in some respects to be more human-minded than many mammals, owing to their erect position in all cases, frequent habit of perching, and general power of flight—all tending to give them a wider outlook than quadrupeds—in addition to the habit of getting information from sight and hearing as we do, and not, like most of the lower mammals, thinking through their noses and thus getting an entirely different set of impressions to guide their conduct.

These similarities to us seem quite sufficient to outweigh what ought to be the handicap of a non-convoluted brain; and in any case, too much stress may be laid on these anatomical characters. Rodents have non-convoluted brains, but no one would accuse a rat of want of intelligence on that account, and similarly among birds there are plenty of species in many different groups that can compare in intellectual power with almost any of the mammals other than man. They all of course stop short of human ability just where the higher beasts do—when the power of speech is needed to communicate impressions.

In observing the habits of the young chimpanzees which our most enterprising dealer, Mr. J. D. Hamlyn, imports and hands over to his talented wife to receive the rudiments of a human education, I have been impressed with the fact that these apes are quite as human as children, at least till the age at which a child should acquire speech; but in one which was kept in the Hamlyn establishment for two years it seemed to me that there was no tendency to further progress, as there would have been in a child, and this one instance strikes me as more valuable than many observations on apes made to lead the dull monotonous life to which they are condemned in public collections.

In estimating the intelligence of birds, we are apt to be deceived by not understanding their expressions of feeling, which are, except in the case of Owls, which have faces of a recognizably similar

type to our own, not at first easy to interpret. Thus, it is difficult to see in many cases if a bird is observing anything or not; every one must have wondered at the apparent unobservance of common Pigeons when a cat is stalking them, until their flight at the right moment shows that they had properly estimated the danger and were awake to it all the time.

Woodpigeons, too, with an expression of stupidity hardly equalled by any other creature, have yet "sized up" the habits of man in a most scientific way; petted as they are in London, they will fly away from a single individual walking through a park in which they will settle on the hands of a person where others are about, showing that they have grasped the fact that men when in company do not assault Pigeons, though a single individual may be dangerous by owning a gun, for instance.

The apparently unseeing stare of so many birds is no doubt the reason why they may often falsely appear to us to be indifferent to the display of the other sex, though there is also plenty of proof that the said display may really leave them unmoved or even cause anger; thus, I have often seen the hen Sparrow and in one case even the hen of the beautiful Orange Bishop Finch (*Pyromelana franciscana*) turn savagely on the male as he was showing off before her. Similarly, one very likely underrates the scenting powers of birds because they do not sniff, having rigid-edged nostrils, but they no doubt often detect odours nevertheless.

We must always remember that the mind of birds is more like that of a young child or of a savage than of an adult of a civilized race of men, and this will help us to understand their actions in many difficult cases. The apparent indifference of birds to courting displays, for instance, may be very like the behaviour of small children to a stranger who takes notice of them; children are often in such a case apparently quite unconcerned, but their friendliness on the next occasion, or what one is told by their parents, will generally show that they appreciated advances which they seemed to ignore at the time—a fact I have often been witness of, as I have the honour to be among those in whom children instinctively place confidence.

When a bird happens to have the same mode of expression as a mammal, the resemblance in its actions is often startlingly close; thus, for instance, it is well known that beasts have a habit—which appears generally considered extremely touching, but is to me peculiarly nasty—of licking their friends. Birds do not generally do this, not because they are cold-natured, but because it is not generally their custom to lick anybody or anything; but, to my great interest, a specimen of the Black Lory (*Chalcopsittacus ater*), the tamest of Parrots and one of a honey-licking group, licked my hand as soon as I put it near the cage on our first introduction at Mr. Ezra's London flat; and a chained specimen whose acquaintance I made years before

in Calcutta dropped from its swing on to my hand, and there lay on its back, and tried, monkey-like, to cling to me when I was leaving it. Others who have had experience with Parrots will be able to recall similar mammalian-like actions; and they, together with Hornbills, Guans, and Emus, are certainly as fond of being petted as any cat or dog.

Geese may display very human attributes; I have seen in India a Chinese gander (the usual domestic species there) sitting beside his favourite goose which was incubating, with his neck laid across her back, a position precisely analogous to the embracing arm of a loving man or ape; and from the time of the philosopher Lacydes onwards, instances have been recorded of common Geese taking a fancy to individuals and following them about with the fidelity traditionally associated with dogs; traditionally but not scientifically, because if dogs were universally or even usually faithful they could not be sold or otherwise change owners.

The most remarkable case of this that has come to my knowledge is recorded by J. T. Smith, who says in his "Book for a Rainy Day" that his mother found when at Greenwich in 1766 a Goose which used to go the rounds with an old woman who sold pies and cheesecakes, and cackled at each customer's door, going off to the next house if the words "Not to-day" were uttered, and so on till the day's business was done.

In spite of their stupid appearance, Geese are well known to be so intelligent that such occur-

rences are not surprising; Crows, on the other hand, both look and are intelligent, as every one knows, and I had not been long in India before I saw played a trick which was often repeated before my eyes afterwards; the House-Crows would settle near a Kite which had alighted on a building with a piece of food too heavy to devour on the wing, one taking up a position in front and one behind it, and the game was then for the Crow in front to badger the Kite until a favourable opportunity occurred for the confederate in the rear to jerk its tail, when of course the booty was snatched by the front bird as the infuriated Hawk turned round.

As the Crows would pull a Kite's tail at any time when the Kite was pre-occupied, as when drinking or picking up a stick for its nest, it is easy to see how the idea suggested itself, but the working out of the plan showed intelligence, and the co-operation was explained by what I ultimately observed, that the Crow which took the post of danger in front allowed the other to take best part of the spoil, thus showing that in all probability a pair worked together, the easiest part of the plan, the tail-pulling, being left to the share of the weaker sex. I have heard and read of the same tactics being used with dogs, but never saw this.

With a young Kite in its first plumage I have even seen a Crow dash in and boldly snatch the food from it direct. Only on one occasion did I see the wily Crows "bested" by a Kite. This bird, no doubt taught by painful experience, had

alighted in a strategic position on the corner of a flat roof where it could not be assailed from behind; and when two Crows appeared, evidently anxious to obtain its booty, the entrails of a fowl, which trailed across the roof for a foot or so away from it, the Kite gathered up this loose portion under its feet, and went on with its meal in a most unconcerned way, while the disappointed Crows sheered off in search of something easier to steal.

Although one must not attach undue importance to their power of imitating our speech, there can be no doubt, I think, that Parrots are highly intelligent birds; in fact, I can never understand why they are not still placed, as they were by some naturalists, such as Edward Blyth, quite the greatest of ornithologists, at the head of the bird class, since they present so many analogies with the monkeys amongst mammals. Even the little Budgerigar, with its Finch-like habits, is a far more intelligent bird than any ordinary Finch, for, once its nervousness is overcome, it readily learns tricks, much more so, I am told by Mr. J. Harris, who makes a speciality of training these birds, than the Greenfinch, a bird of about the same size, and not stupid as Finches go.

Most people would probably say the common grey African Parrot is the most intelligent of birds, and, though its natural shyness results in its intelligence being known generally only to its immediate acquaintance, I have twice known it do remarkably human things. In one case a bird boarded out

at a dealer's shop, a good talker in two languages I was told, had become independent of the usual head-scratching by human fingers, for it would scratch its head itself with the swing in its cage, grasping this with one foot as it stood on the perch below, and moving it backwards and forwards over its poll.

The other bird I was told of when delivering a course of lectures at Maidenhead some years ago; this would scratch its head with a piece of stick, according to the account given me, and though with the usual perversity of the species it refused to perform in my presence, it did at any rate condescend to take the stick proffered by its owner in its foot and hold it a while.

From my own experience I think I should rate the great Salmon-crested Cockatoo of the Moluccas (*Cacatua moluccensis*) as the most intelligent of birds; this will even make use of signs to intimate its wishes, for when one approaches a Cockatoo of this kind—they are always tame, being presumably hand-reared—it will commence stroking its head with its foot in an obvious invitation to "scratch a poll" which is quite sincere, for I have never known one abuse the confidence reposed in its tameness.

The only other Parrot I have seen make this sign, and that more rarely, is the large Red-and-Blue Macaw (*Ara chloroptera*), and this also is the only bird I have seen smiling; when so doing it extends the upper bill straight forwards and draws back

the corners of the mouth, producing a weirdly ugly expression which might easily be mistaken for yawning, but is assumed under quite appropriate circumstances for a smile, as when the bird is being petted and played with by some one whom it knows and likes.

Generally speaking, in birds of the same group the larger species will be found more intelligent and of more marked character than the smaller, though there are numerous exceptions to this; for instance, an aviary of Parrakeets can be kept up with much more safety than a collection of Cockatoos and Macaws, and in a pond stocked with waterfowl it will be found that all species larger than the common Wild Duck are not only more tameable and intelligent than that bird, but much more jealous and vindictive, and apt to pursue their quarrels to the death, while the squabblings of the smaller species seldom lead to anything serious.

Pronounced vigour of character is, however, also a prerogative of certain special types; thus among Parrots the Conures, though not large, are birds of much character, and among Ducks the Sheldrakes, though considerably smaller than the Geese. Among small birds, too, I have found the Pekin Robin (*Liothrix luteus*) a remarkably intelligent species, with plenty of presence of mind; if turned out in a garden it will soon find its way back to its companions in captivity, if there be any of its own species, and displays no fear of the mobbing of the Sparrows, which, to do them justice, are

in such cases, according to my experience, actuated more by curiosity than by malice, as I never saw any of the Pekins I turned out in London parks hurt by them, even if they happened to be in poor condition.

I even saw one of these birds rob a London Sparrow very cleverly; the Sparrow had carried a bit of bread under the bush in which *Liothrix* was perched, when the Chinese bird jabbered at him, giving his alarm-note, and the Sparrow fled in terror, leaving the bread to be appropriated by his rival. Another bird of this kind, placed in an aviary in Calcutta, detected and seized a small cockroach which lived in a crevice and had baffled the other inmates before he had been in the place five minutes; and on a perch having fallen down with a great clatter on being shifted, was down on the next one investigating the cause of the disturbance before the flutter caused thereby among the other inmates of the aviary had subsided.

Should any one be anxious to investigate systematically the workings of a bird's mind, I should strongly recommend this knowing little species, which being largely insectivorous has more chance of showing versatile intelligence than a seed-eater, though some of these are very intelligent, not only among Parrots, but among Passerines, such as the Redpoll, Sparrow, and Baya Weaver.

There are undoubtedly many birds and groups of birds whose intelligence is extremely low com-

pared with those I have dealt with; such birds as Bustards, Tinamous, Sand-Grouse, and Pigeons, for instance, though often wary, are not what one would call bright and clever. It will not do, however, to try to estimate a bird's intelligence from its morphological status; for instance, Grebes are supposed to be a "low" type, but my experience of them is that they are very intelligent, far more so than any other waterfowl, at any rate in the case of the Indian Dabchick, a bird which minutely examines everything, and as I proved, knows one person from another, even though not fed by any one.

Parker, from anatomical considerations apparently, saw fit to stigmatize the Rails as a "feeble-minded, cowardly group," which they most emphatically are not, when one comes to know them intimately. The common Moorhen (*Gallinula chloropus*) is, I should say, an infinitely more courageous, intelligent, and generally strong-minded bird than the wild Duck, though that is a good steady-nerved sensible bird as Ducks go. Their behaviour in London well illustrates this, for whereas both birds are kindly treated there, and have been for many years, the Duck can never overcome the timid instinct of hiding its nest, and rarely breeds on small ponds; the Moorhen will often nest in the full view of the public, and at the time of writing a pair had bred for years on a tiny island in a little stone-faced pond in the middle of Goldhawk Road in London, within a few yards of an electric

tramway, a big public-house, and a picture palace! The Moorhen, evidently, would say with Diomed:

> "Thou dost miscall retire.
> I do not fly; but advantageous care
> Withdrew me from the odds of multitude."

In birds of the same group and closely allied the same difference can be seen; the Wood-Pigeon, domiciled in London for only a few decades, has shown itself much more ready to take advantage of human friendship than the House-Pigeon, which has been a public pet there for probably as many centuries. The woodlander is now nesting in absurdly low trees, even in those surrounding Trafalgar Square, and even more readily alights on people's hands to be fed than the other bird does.

Among the Ducks the same thing can be seen; I have only once seen the Carolina Duck dive for food, when a female thus caught a fish at Kew, yet its ally the Mandarin, though less specialized as a swimmer, dives quite frequently for food, and unlike other surface-feeders, goes under with its food when worried by Gulls.

Observers of Humming-birds sometimes comment on the very insect-like behaviour of these tiny birds, but in this I fancy they have been misled by the minute size and insect-like flight, for as far as my observations, which I must admit have been limited to a few captive individuals, have gone, I cannot see that they show less intelligence than

other very small birds, small species being, generally speaking, more childish in their ways than large ones; in fact, the readiness with which Hummingbirds adapt themselves to captivity is rather a proof of high intelligence than otherwise, since such adaptability is often found in birds whose intelligence is known to be high, like wild Geese, which are much more easily tamed than Ducks.

Here, however, temperament may come in; the Ducks are intensely nervous as a rule, a remarkable exception being found in the generalized Tree-Ducks, which come in some ways nearer the Geese, and are certainly like them in disposition. A nervous bird, too, may nevertheless have plenty of character and intelligence; the Pekin Robin, a very intelligent bird, as I have said, is frantic in a small cage, bold and inquisitive in a large one, while the intelligent Sparrow submits to captivity with a very bad grace, bearing it worse than many less intelligent species.

Like all the lower animals, birds have distinct limitations of instinct, even intelligent species constantly failing in adaptation—else they would be human; in the introductory chapter I have spoken of the failure of the Sparrow to acquire the knack of manipulating its food with its feet, and the same may be said of the Starling, also an intelligent and versatile bird; while the intelligent Parrots, except in the case of one species, never think of making nests, so common an instinct with less gifted birds, a peculiarity which no doubt accounts

for the fact that the comparatively very stupid Pigeons, with much the same general distribution and diet, have nevertheless on the whole a wider range and greater success in the struggle for existence, since they can at any rate construct their own cradles, and do not usually depend on holes, found or dug out, for a breeding-place, as Parrots do.

The association between general intelligence and strength of character and the hole-breeding habit is often very marked, occurring in Parrots, Starlings, Tits, and Sheldrakes, for instance, but as it limits the breeding potentialities of birds, it must be regarded as either degeneracy or a blind retention of ancestral custom, as compared with the nest-constructing instinct, and is no doubt favoured by the fitness in other directions of the birds which practise it. It is probably the great and general development of the nest-constructing instinct in the Passerines which accounts largely for the success of these birds, since in general intelligence and strength of constitution they do not seem superior to many other groups.

A very large field of observation is presented by the phenomena of expression of emotion in birds, and it is intimately related to the study of bird courtship; for it is a very important point to notice that the so-called courting pose is often exactly that which is assumed under any emotions such as anger and even fear, and that it is frequently displayed by the hen equally with the cock.

Thus, to take a well-known instance, the Turkey-

cock displays when about to fight just as when showing off to the hen, and she herself may display if the cock is slow in making advances, or if she meditates an attack. The Ruff displays his frill to his rival as well as to the reeve, and even the Peacock has been seen to drive a sitting Swan off her nest by charging down upon her in the display attitude, while I have myself seen a Pea-chick no larger than a Partridge suddenly display its little tail when alarmed by a cat passing close by it. The Muscovy Duck displays when about to pair, when meditating warfare or on alarm—on any excitement, in fact, and the duck is nearly as ready to show off as the drake.

The Swan and Mandarin Duck display magnificently for the purpose of bluff, but when about to pair their movements are quite different and less imposing, the Swan in particular flattening down its wings, expanding the feathers on the head and upper neck, and repeatedly plunging head and neck under water; while among the Tree-Ducks there is frequently a marked display after, but not before, pairing, both partners executing a step-dance in the water with one wing held aloft.

Generally speaking, the gestures of males and females in display are the same, but there are some exceptions; thus, among the typical Ducks—the Mallard and its allies—the duck and drake use quite different actions, though there is a marked exception in the case of the beautiful Falcated or Bronze-capped Duck (*Eunetta falcata*), in which

the very soberly coloured females show off simultaneously with, and with the same gestures as, the highly decorated drakes, which is more than Mandarin Ducks usually do, though they exhibit drake-displays occasionally. In a case I noted one winter when a pair of Blackbirds were disputing over food, I observed both cock and hen running around with trailing spread tails, as cock Blackbirds do when courting.

As Darwin has remarked, all individuals of a species display in the same way, and he might have gone further, and said that the display is often a group-character, and common to many allied species; though, on the other hand, one gets sudden differences in this respect between near allies at times, just as one does in the case of notes, eggs, and colouring and decorations.

The Duck tribe furnish good examples of this; generally speaking, one may say they never display by drooping their wings, though such a show-gesture is a common one among birds. But display by raising the elbows, and thus erecting the secondary quills, is familiar in many species, especially the white and black Swans, though the Black-necked Swan (*Cygnus nigricollis*) does not practise it; the males of Ducks most nearly allied to the Mallard rear and curtsey just as that bird does, the plain-coloured species (like the Australian Mallard and Yellow-billed Chilian Teal, *Nettium flavirostre*) doing so just like the sex-decorated forms, an important point, since it shows the display

is older than the decoration; while the Mandarin and Carolina Ducks, nearly allied as they are, seem to have gone out of their way to display differently, the former raising his crest as much as possible, and throwing his head back and breast out like a Fantail Pigeon, while the latter raises his head and tail as if he were being lifted up by an invisible string attached to each end, and positively flattens down his crest as much as possible.

This is a particularly interesting case, first because the displays of other twin species with high decoration—the two Peafowl, the common Turkey and the brilliant Honduras Turkey (*Meleagris ocellata*), and the Golden and Amherst Pheasants—are almost exactly alike, and secondly because it is very rare for a bird to reduce instead of displaying a decorative feature, although a similar case is found in the Bulbuls, which also depress their handsome crests when courting, though they erect them when alert, as does the Carolina drake also.

It is very noticeable that whenever a bird has any white about it, this is almost invariably the main feature of the display, no matter what other colours are present; this is well seen in the courtship of the Magpie and the Great Bustard, and the peculiar gesture of the Carolina drake is well adapted to show off his white throat, while the crest-expansion of his ally may be connected with the fact that he has much more white in his headdress. On the other hand, the rear-up of the Bronze-Cap drake conceals his white throat, as he

bends down his head after the fashion of his allies the Gadwall and Teal when executing this gesture.

But another very striking display of white is that of the Moorhen, which makes a great show of its white under-tail plumage when angry, defiant, or amorous, and the blue Porphyrio of India (*Porphyrio poliocephalus*) does the same thing. This bird also claps its wings over its back when excited, a gesture also found in the Globose Curassow cock, and as every one knows, in our common Chanticleer; especially does he do this before crowing, but the Grey Jungle-Fowl (*Gallus sonnerati*) does not, so far as I have seen, and the green Javan Jungle-Fowl (*G. varius*) claps its wings *after* crowing, like the Pheasants, which is interesting, as this species is the most Pheasant-like of the Jungle-Fowl. In the Silver Pheasant the crow is suppressed and the wing-flapping becomes a buzz, though to me no sound is audible, but the allied Lineated Kaleege (*Gennæus lineatus*) is credited with making a noise which suggests an earthquake, and the drumming of the courting Ruffed Grouse of America (*Bonasa umbellus*) is apparently produced by a similar very rapid agitation of the wings.

It is in one of the Grouse that courting emotion appears to reach its highest pitch; in the well-known love-song and display of the Capercaillie the performer gets so excited at the highest pitch of the performance that he gnashes and foams, closes his eyes, and becomes deaf by the swelling of the soft palate, while the tree he is perched on

absolutely trembles; it is at this point that sportsmen on the Continent advance in stalking him, though the admiring hens do their best to give warning. Gnashing or snapping of the beak under excitement occurs, by the way, among various other birds; it is particularly to be noted in Owls when menaced, and in the cock Rhea when anxious about the safety of his brood.

The attachment shown by the Capercaillie hens to the cock has parallels elsewhere, notably in the fondness Peahens display for their favoured mate; Heron states that his birds went unmated one whole season because their favourite was shut up, but in a wired run where he was still in view; yet his rival was a black-winged bird, more beautiful than the type, and the successful bird was pied. I recently, however, saw a Peahen in Regent's Park associate persistently with a black-winged Peacock instead of a common one; but the former was nevertheless inferior in beauty, as he only bore his first full train, while the other bird was at his best. The older bird, although feared by the younger, did not press his advantage; and it is this propensity to leave matters to the female's choice that makes Peafowl and Mandarin Ducks so suitable for the study of sexual selection, for birds which fight matters out upset the issue.

In Peafowl the male seems to have no sentiment about the hen, but in many birds the male is selective whenever he gets the chance, which seldom happens in the wild state, females being at

a premium; the preferences of Fowls for particular hens are, however, well known, and Chaucer makes a great point of this in his story of Chanticleer and Partlet. I have myself seen a large half-Spanish cock always accompanied by bantam hens, where the attachment must have been mutual, as he was master of the yard and could have had his choice, while he could not have compelled the attendance of such active little creatures had they not actually preferred him to the bantam cocks.

A Buff Cochin which was the pride of my boyish poultry-fancying also was much in love with the smallest and prettiest of our mongrel hens, and a Globose Curassow cock at the Zoo was devoted to a hen of the handsome zebra-marked aberrational type described as *Crax hecki*, preferring her to three normal brown hens. He bred with her twice, and when separated from her on the second occasion lest his fury in defence should endanger the chick (which, by the way, is a hen, and typical *globicera*), moped and would not eat for some days. Such grief is not unusual among birds of strong character; Rogeron cites a case in which a Carolina Drake died of nothing else but shock at the death of his mate, and Hume gives two instances justifying the current belief in India that if one of a pair of Sarus Cranes is shot the other will pine to death.

Besides love, birds exhibit hatred in a very marked degree; their general rancour against Owls is very noticeable, and high-spirited species

of the same group often display marked animosity when they meet; for instance, Sheldrakes have a general aversion to Geese, and usually bully them, in spite of their own smaller size. The jealousy of male birds is well known, and of course leads to numerous fights; but male birds will also fight over nesting-sites, as I have seen in India with the House-Mynah, the hens looking on as seconds.

The mobbing of Hawks and Owls is no doubt often dictated by revenge; and birds may be observed sometimes to harbour a grudge. M. Rogeron describes a Brazilian Teal (*Nettium brasiliense*) which had provoked a rather hot-tempered Mallard Duck and been nearly drowned by her in consequence, as never failing afterwards, whenever he could do so safely, to smack her across the face with his wing. Dr. A. G. Butler gives a case in which a Whydah-bird, whose long tail-plumes had been plucked out one by one by a pair of nesting Song-Sparrows, bided its time and killed one of the little thieves; and in the Calcutta Zoo a pair of African Triangular-spotted Pigeons (*Columba guinea*), which had been much annoyed by the futile attacks of a male Cockatiel (*Calopsittacus novæ-hollandiæ*) which was breeding in the same enclosure, revenged themselves on him by pecking his young, when they left the nest, most severely. This was an unusual procedure on the part of Pigeons, which are not usually aggressive to birds not of their own family.

As much may be said of most birds whose intelli-

gence is low; unfortunately the higher in type the mind of the bird, the more apt it is to be indiscriminately vicious, as one may see in Parrots, Crows, Weavers, and Sheldrakes. The Caracara Carrion-Hawk (*Polyborus brasiliensis*) is also more mischievous than other less intelligent birds of prey; I have even known one in the Calcutta Zoo deliberately take any extra bit of food given him up to the partition-bars separating him from an Imperial Eagle (*Aquila imperialis*), solely to enjoy that bird's discomfiture at seeing food he could not himself obtain.

Some birds are so churlish that they like as a rule to be alone; such are the "nobler" birds of prey—Falcons and Eagles—and most Thrushes, especially the Robins and Nightingales; it is to be noted that these, the finest singers, are also the most cantankerous, and their most thrilling music is, it is to be feared, often only a "hymn of hate"; but at the same time, hen birds are undoubtedly impressed by song, and canary-fanciers are constantly being troubled by a hen bird "pairing by the voice," and so upsetting any matrimonial arrangements they themselves have made for her, for no other suitor will be well received in such a case until the favoured troubadour is out of hearing.

It is quite a common thing to see affectionate birds express their love for each other by fondling each other's head with their bills, an attention which human onlookers are apt to mistake for a search for parasites. This is often a group-

character, being very noticeable in Pigeons, Parrots, Babblers, and Waxbills, for instance; but it also occurs in other groups sporadically, being practised by Penguins, Tree-Ducks, and Coots among waterfowl, and by the Talking-Mynahs among the Starlings. I have even seen a Muscovy Duck caress her downy ducklings with her bill, this species being the most motherly of all the Ducks, while her ducklings for their part seem to cling to her more than do those of others.

The caressing habit is connected with high sociability in many cases, *i.e.* with a tendency to associate in larger numbers than single pairs, and to combine for mutual defence; thus, the small Indian Tree-Ducks will tackle other waterfowl several together, and Mr. H. Wormald has lately recorded how the White-faced Tree-Ducks (*Dendrocycna viduata*) recently reared by him resented the handling of one of their number, gathering round with drooping wings—a very remarkable gesture for Ducks—and flying up as if to effect a rescue of the prisoner.

This drooping of the wings under social excitement is no doubt the origin of the "shamming lame" behaviour common to so many birds when beguiling enemies away from their nests and young, as in the case of the Partridge, Lapwing, and Sheldrake; though no doubt the habit, emotional at first, becomes afterwards an intelligent action, in some cases at all events. Similarly, the "shamming dead" action, as exemplified by the

Landrail and Tinamou, is regarded by Mr. Hudson as a kind of swoon induced by extreme terror; but I have noticed that cock Purple Sun-birds (*Cinnyris asiatica*) when attacked by a rival in confinement, hang from the perch by the feet as if dead, which looks rather like a *ruse de guerre*.

Sun-birds, like all honey-eating birds, are very pugnacious, but among these sweet-loving swash-bucklers some, the comparatively large plain-coloured Friar-birds of Australasia (*Philedon*), are full of social instinct, and unite to drive off Hawks and Crows. Hence has arisen the idea that they are "mimicked," unconsciously of course, by some Orioles which live in the same islands and resemble them in their sober snuff-brown colours; but as the ordinary gorgeous Orioles of Asia and Africa get on all right without mimicry, and as in Australia itself the Orioles, though not very bright, do not in the least resemble the local Friar-birds, the theory is unnecessary.

The police instinct which leads high-spirited birds of active flight to attack predatory species is, however, usually developed among solitary rather than social species; the King-bird (*Tyrannus carolinensis*) of North America is perhaps the most striking exponent of this policy, but he has a worthy rival in the very abundant and conspicuous "King-Crow," or common Drongo Shrike of the East, while in Europe the Missel-Thrush takes up police duty.

Birds may even assume the function of warning

AMERICAN KING-BIRD.

The King-bird is dark grey above and white below, with a flame-coloured crest, which, when displayed, is said to attract insects.

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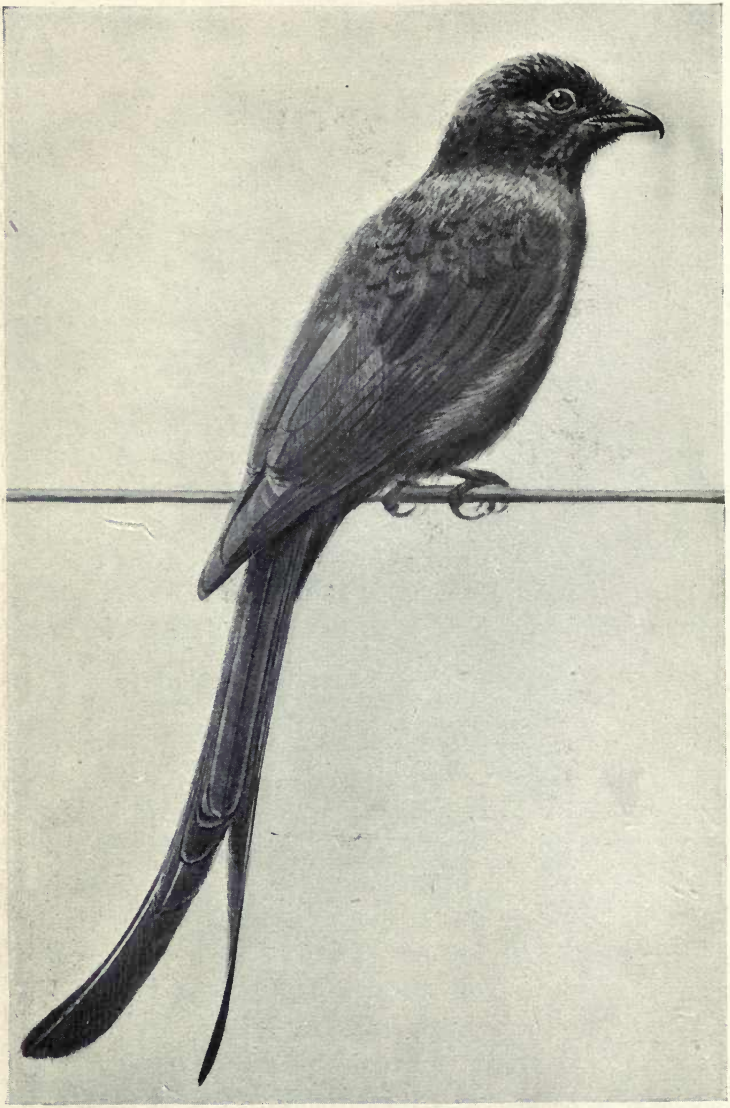


KING-CROW.

The King-crow, being very common, and habitually perching in conspicuous places, is one of the best-known birds in the Old-World Tropics.

[*By permission of "The Graphic."*

other species against man, as gunners in this country well know in the case of the Curlew and Redshank, while in India the Ruddy Sheldrake is the best known sentinel. In the case of this bird the motive is certainly not philanthropic, or rather philornithic, for, as may be seen in our parks, it cherishes an extensive prejudice against all other waterfowl, but being naturally wary and excessively noisy to boot, it becomes automatically the watchman for its neighbours. Flocking birds of the more intelligent kinds very commonly have sentinels of their own flock, and in the case of wild Geese the process of changing sentry has been observed; the sentinel may be approached by one of the flock and touched, after which it lowers its head and begins to feed, while the relief bird assumes the watching position—or it may, as has also been seen, force another bird to take its turn by dealing it a hard peck.

In some cases, as is well known, sociability amongst birds extends to social nesting, familiar to us in the case of Rooks and Sand-Martins, though it is more common among sea-fowl—in which it is usual—than land-birds. The well-known Social Weaver, the Republican Grosbeak of the old naturalists (*Philetærus socius*), carries the social habit, usual among Weavers, so far as to construct a common roof of grass, under which each pair constructs its own nest, and a somewhat similar habit has been alluded to above in the case of the only nest-building Parrot. As a general rule, however,

even birds which are social in winter nest in separate pairs, though associations of two males and one female, or *vice versâ*, have been recorded; and polygamy is well known in many game-birds and in Whydah-birds (*Viduinæ*), while polyandry appears to be normal in Hemipodes and Tinamous, and the parasitic nesters like Cuckoos and Cow-birds are credited with promiscuity.

Generally, however, the pair are faithful, not only for the season, but, so far as evidence goes, for several years, probably until a stronger rival ousts the older and weaker partner, for strength appears to be the chief determining factor in bird marriage. At the same time, sentiment presumably has something to do with it, because one so often sees cross-matings among the various species of Geese kept in our parks; Geese are very intelligent, and not very amorous, and wild hybrids among them are practically unknown, so that it would seem that these irregular alliances are dictated by congeniality of disposition where there are but few of each species to choose from.

CHAPTER X

Song and cries of birds—Bird-language generally—Extent to which the notes are instinctively developed—The instinct of mimicry—Species which can imitate human speech—Problem of this ability and extent of exercise of the same—Possibility of understanding of bird-language by man.

FROM the earliest historical times the voices of birds have attracted at least as much attention as their flight and plumage, as is natural, for they are the most vocal of all animals, voice being more characteristic of them than flight, for there are a good number of flightless species, as we have seen, while none are destitute of voice at all ages and in both sexes; for even among the typical Storks, which have evolved a sort of deaf-and-dumb language by clattering the bill, the nestlings utter wheezing squeaks, and although some of the males of the Ducks are nearly voiceless, such as the Muscovy drake, which only utters a wheezing sound as if panting for breath, the females always have a distinct loud note, though in the case of the Muscovy Duck this is rarely uttered.

The curious bulb found at the base of the windpipe in so many of the males of the Duck tribe seems to act as a damper to the quack of the drake;

thus, in the common drake, though he can make a much louder noise than the Muscovy, the quack sounds exactly as if he had an extremely bad cold. Drakes, indeed, can seldom produce so full a sound as the ducks, and the voices of the two sexes are not interchangeable as they are in some other birds—most of my readers must have come across a crowing hen or a singing female Canary, and every one knows the cock can cluck and cackle just as much as the hen.

The voice of birds is produced in the syrinx, a special vocal organ situated at the base of the windpipe just at its bifurcation to enter the lungs, and it is here in the drakes that the " drum " is developed where it exists. Where it is present but very small, as in the Ruddy Sheldrake (*Casarca rutila*), the drake may have as strong a voice as the duck, and where it is absent, as in the tiny Cotton-Teal (*Nettopus coromandelianus*) the drake's note may be stronger, the male in this little Duck cackling loudly, while the female only squeaks like a duckling. In the Tree-ducks there is no bulb, and both sexes have a strong voice, uttering a whistling cackle or a subdued twitter; in fact, they can modify their voices almost like the singing Passerine birds.

In the latter the vocal muscles developed at the base of the windpipe are particularly strong, but the same development is found in the Crows, which are not commonly reckoned as songsters, and in one type of Passerine bird supposed to have a

lower grade of "syrinx," as this vocal organ is called, the Lyre-bird (*Menura*) of Australia, the voice is very flexible and the bird is a splendid mocker even when wild, and has been known when brought up tame even to imitate human speech.

In the groups with the greatest perfection of vocal organs great imitative faculty is common, as we see in the case of the Starling and Jay, both of them well known as talkers when tamed, and given to imitating various sounds—generally cries of other birds—when wild. The Crows and Starlings generally are the chief talkers and mockers, and exercise the latter faculty even in the wild state. Many people must have heard the Starling's imitations delivered from a chimney-pot, and the African White-necked Crow (*Corvus scapulatus*) has been known to amuse himself by imitating a Bustard's call, to the great discomfiture of the pursuing sportsman. The abilities of our Sedge-Warbler and of the American Mocking-bird (*Mimus orpheus*) are also well known, and so are those of the New Zealand Tui or Parson-bird (*Prosthemadera novæ-zealandiæ*), one of the honey-eaters.

In fact, in every country with a reasonably varied bird-population there is sure to be some species with the mocking faculty, exercised apparently purely for the pleasure it gives as a rule. Audubon, however, credits the Northern Shrike (*Lanius borealis*) with beguiling small birds within its reach by imitating the cries of a bird in distress, and Dame Juliana Berners, in the Middle Ages, strongly

denounced our nearly-allied Great Grey Shrike (*Lanius excubitor*) as an "ungratefull subtill fowle" for the same treacherous manœuvre.

But it is curious that such imitative birds do not, when wild, generally copy human speech, though I have myself come across a case which seemed very like it; when living a few years ago just north of Regent's Park, I used to hear a voice in the very early morning outside my bedroom saying "Pretty Polly," and at first blamed some one for unfeelingly putting out an unfortunate Parrot to shiver in its cage in a cold spring dawn; but ultimately I found the talker to be a wild Blackbird, which came to sing his matin song—which, as every observer knows, is more varied than his musical performances given later on in the day—from a very tall tree in a garden at the back of my bedroom. Unless the utterance of these words was a mere "fluke," he had probably picked them up at some time from a Parrot, for the Blackbird is at times imitative, though not nearly so much so as the Starling or Sedge-Warbler, or even the Song-Thrush. If the resemblance to human speech were merely accidental, this might explain Pliny's story of the "talking Thrush" in the possession of the Empress Agrippina in his day, for the Thrush is notorious for the human-like phrasing of its song.

I do not know that the well-known and celebrated black talking Hill-Mynahs (*Eulabes*) of the East exercise any mocking faculty when wild, but if they do not it would be nothing wonderful, con-

sidering the talking faculties of Parrots, which have a less elaborate vocal apparatus than these Mynahs or other Passerine birds, and seem to have no imitative faculty at all until reclaimed by man; though as a matter of fact, I do not suppose much is known of the intimate habits of Parrots, which, like most birds of particular interest to the "man in the street," are neglected by ornithologists, and are in any case not easy to study when wild, most of them either spending all their lives in the tree-tops, or at any rate retiring to them when not feeding.

At least one can sing, however, the familiar little Budgerigar, and this bird, when hand-reared, can be taught to talk—hardly any Parrot, by the way, will learn anything when adult; but in the case of the present species I have known an unmated cock, kept in an aviary along with a Thrush and other birds, learn the Thrush's rather complex song quite perfectly, though of course his rendering of it was in a very "still, small voice."

Several of the other non-passerine groups contain singers, song having been recorded in Hornbills, Kingfishers, and Humming-birds, the singer in the last case being the smallest or almost the smallest of all, the Vervain Humming-bird (*Mellisuga minima*); in fact, generally speaking, song-birds are small members of their groups, the large Lyre-bird being quite an exception. The Amherst and Cheer Pheasants also undoubtedly sing, if the song is not very musical, and observers of that charming

little diver, the Long-tailed Duck of our northern coasts (*Harelda glacialis*), speak of its "song."

Song, it must be understood, is quite a conventional term when used in the ordinary way; technically it means any noise which is not a call-note; thus the Cock's crow is just as much a song as the Nightingale's musical efforts. With short simple songs like the Cock's crow and the Chaffinch's short outburst, the development is instinctive; but anything more complicated has generally to be learnt from others of the species, and the result of this is that a hand-reared bird, if uneducated, sometimes turns out a most extraordinary jumble in which no trace of the proper song can be detected. Thus, an old school friend of mine, Mr. C. Bardwell Clarke, brought up a young Linnet, which, reared in a town, developed no Linnet notes at all, but sang a jumble of the Starlings' whistles and the chattering of the Sparrows; and conversely, a Sparrow brought up with singing birds will produce a noise we can accept as song, instead of the "chip, chip, cheer" which seems to be the natural and spontaneous outpouring of the Sparrow's soul.

The Brambling, by the way, is an example of another Finch which sings disgracefully for a member of a family including such talented creatures as the Linnet and Canary, for the only note in his song is "zee-e," an expression of emotion which can be bettered even by Pheasants and waterfowl.

It is only among Passerines and Parrots, however, that the power of mimicry occurs, and hence only

these birds are ever talkers, for only imitative birds have the power of speech, though not by any means all of such species ever develop it, however great may be their opportunities when kept tame.

Considering the difference in the vocal organs of birds and men, this imitation of our speech is certainly not the least wonderful of their peculiarities, especially as vocal mimicry under natural conditions cannot be of the least service to them as a rule, but is merely latent altogether, as seems to be the case with Parrots in the wild state, or is only used by way of amusement, with the exception of the Shrike's alleged treacherous custom. An Indian Shrike which preys on frogs, by the way, has been noticed to incorporate the screams of the hapless batrachians in its song, so that it is quite easy to see how the Great Grey Shrikes of the north might easily begin imitating the cries of distressed birds merely for amusement, and then develop the habit for profit as well as pastime, as described by Audubon and Dame Berners.

This would make a close approach to rational speech, and no one who has seen much of intelligent Parrots can doubt that these birds have at least some idea of the meaning of what they say. For instance, I have never heard, or heard of, any Parrot ask for any sort of refreshment unless it saw food, or use any inappropriate word at such times, though it might not know the exact expression. Such a bird, for instance, behaves much like a person groping a way through a foreign language,

or a child learning to speak. Thus, I have known a Lemon-crested Cockatoo which always said " Cocky wants some breakfast " or " Cocky wants some water " at meal-times, obviously not knowing the exact words, but at any rate using expressions which had something to do with refreshment. He never said " Good-night " at such times, though he said this regularly when left alone finally in the evening.

Every one who has had acquaintance with one of the larger and more intelligent Parrots will recollect instances like this, and if Parrots do not develop a higher degree of rational conversation than they do, this is partly due to the fault of their teachers, as well as to the paucity of ideas one would expect in one of the lower animals.

Other talking birds, such as Mynahs, Ravens, etc., seem not to be so rational in their conversation as Parrots, however good their enunciation may be, and though I have heard Mynahs make some astonishingly apposite-sounding remarks, this result always seemed to me to be purely accidental, and not due to the attempt to really utilize speech as Parrot sometimes do.

In Parrots at all events talking power has nothing to do with sex, for female birds talk just as well as males ; in fact, one experienced dealer, Mr. C. P. Arthur, who is also a taxidermist and has thus dissected many of the well-known African Grey Parrots, states that in his experience he never came across a male of this species. This may have to do with the fact—if it is a fact—that Parrots

are not naturally mockers, but only develop the imitative habit under human control and cultivation; for, as every one knows, Passerine birds, to which all other talking and mocking species belong, generally only sing when of the male sex. And though to this there are numerous exceptions, of which the hen of the beautiful Red Cardinal of America (*Cardinalis cardinalis*) is perhaps the best known, still there is no hen bird which sings *better* than her mate, and none which sings while the male is mute; though, as we have seen in the case of the Ducks, and as is also the case with the Guinea-Fowl, the female may have a much stronger voice than the male. In these cases, however, he is still much more loquacious than she is, and although his voice to us sounds weaker, her ear may be more attuned to it.

There are some curious cases of coincidental resemblances between voices of unrelated birds and between sounds made by birds and by mammals and even produced by mechanical means, which deserve attention. Many people must have noticed the great resemblance between the piping call of the Kingfisher and that of the common Sandpiper, and between the note of the Kestrel and that of the Wryneck. I have noted others in cases where the birds do not occupy the same country, at any rate when breeding; thus the pretty Wire-tailed Swallow (*Hirundo smithii*) of Africa and India has exactly the same call-note "swee-et" as the Canary, an Azorean species; and an Australian Dove

(*Geopelia humeralis*) has one note exactly like that of the common Cuckoo.

Cuckoos themselves are just as remarkable for curious notes as for parasitism and for resemblances in appearance to birds of alien families; thus we have the well-known "Brain-fever-bird" of India (*Hierococcyx varius*), with its strange trisyllabic notes running up the scale, and preceded by an overture, while the dissyllabic note of the Koel (*Eudynamis honorata*) also runs up the scale. Our own Cuckoo's note is known to be so truly musical that it can be imitated easily by mechanical means and even struck on the piano, and as every one knows is so readily rendered by the human voice that "early Cuckoos" are always regarded with grave suspicion.

Nightjars also have many strange notes, the machine-like whirring of our familiar species being rivalled by the singular sound produced by a common Indian species (*Caprimulgus indicus*), which is just like the sound of a stone bounced along ice; and the human-sounding notes of the American "Whip-poor-will" (*Caprimulgus vociferus*) have long been celebrated.

Other mammalian voices besides man's come in for this fortuitous imitation; the roar of the cock Ostrich is not unlike that of the lion, and the American Cat-bird (*Galeoscoptes carolinensis*), which is a Mocking-Thrush, and the Australian Cat-bird (*Ælurœdus viridis*), one of the Bower-birds, have obtained their names from their cat-calls, while

the Eagle yelps like a little dog, and the Bittern bellows like a bull.

Resemblances to mechanical sounds are also curiously common elsewhere than among Night-jars; the Coppersmith Barbet's note is just like a little gong regularly beaten; and the Naked-throated Bell-bird (*Chasmorhynchus nudicollis*) of South America has a really magnificent metallic clang, like a bar of iron struck with a rod, which, overpowering though it is close at hand, is, I think, at a reasonable distance, the finest bird note I have ever heard. The more celebrated Bell-bird proper (*C. niveus*), whose note is said to be like a church bell, is nearly related.

Old legends and fairy-tales are full of allusions to people who could understand the speech of birds, and, quite apart from talking birds which undoubtedly do at times make their linguistic acquirements serve their ends, there seems to me considerable possibility of men understanding the notes and gestures of birds at least as well as these do each other. A man and a bird may have the same idea at once; thus, just before I saw the Song-Thrush above-mentioned catch the minnow, I remember thinking, "I wonder if that bird could catch one of those fish;" and on the first occasion on which I saw a Peahen take distinct notice of a Peacock's display, gazing attentively at his train, the Peacock and I both had the same idea—that the favourable moment had come; and we were both mistaken, and mistaken twice in quick succession.

In watching waterfowl I have had similar experiences; at the time of writing the waterfowl at St. James's Park were restricted to a comparatively small area of water at the east end of the park, the rest of the pond being drained, and the young Mallard ducklings have been coming close up to the path to be fed. An old Duck, watching her brood with anxious quacks, gave an extra loud one as a Canadian Goose came too near them for her satisfaction, and the ducklings bolted helter-skelter into the pond. Now it was perfectly obvious that all the old Duck meant to say was "Keep away from that Goose"—a few feet's retirement would have been sufficient; but all her vocabulary allowed was "danger," and the ducklings promptly acted on the word. Here I could understand the Duck, but the ducklings could not; in another case a drake and I were both at a loss. A pair of Mandarin Ducks were, at a dealer's, confined in a hutch with perches, and were roosting on the top one. The duck started pulling at the drake's crest until she fairly upset him, and he fell to the floor; but when he mounted again she let him alone, being now next the wall, and it became obvious to me that she wanted the inside berth, was not active enough to jump over him, and could not explain to him any more than to me that she wanted him to get out of her way.

CHAPTER XI

Weapons and fighting methods of birds—Their combats with each other and with various natural enemies—Chief enemies of birds—The passive resistance of birds to unfavourable climate and surroundings—Natural defences—Perfection and degeneracy of plumage in this connection—Powder-coating of some groups.

In the state of war in which birds, like other wild creatures, perforce exist, they are naturally often called upon to fight, though better qualified, by their general power of flight, for escaping than most other creatures; and it is noticeable that some of the most formidable fighters are found amongst those in which the power of flight is wanting or not highly developed—the great running-birds and the Game-bird tribe. The Ostrich holds its own among the African quadrupeds by dint of the power of its great feet, the single claw on the longer of its two toes being such a terrible weapon that it can pierce corrugated iron; and any beast up to the size of a hyæna has to avoid the Ostrich's wrath. These great birds draw themselves up and strike out with one foot, the Emu and Cassowary being very formidable kickers as well as the Ostrich. In the Cassowaries one of the claws, the innermost, is specialized as a weapon, being unusually long

and straight; and the native tribes which inhabit regions where these birds live use it as a head for their spears.

The Rheas fight with bill as well as feet, holding on like bull-dogs, and bill- and foot-fighting is the rule among the Game-birds; every observer must have seen how fighting cocks strive to get a hold with the bill and with that purchase to deliver a telling blow with the spurred legs.

It is only among the Game-birds that spurs on the leg occur at all, and they are generally single, and normally confined to the male, as in the Fowl, Turkey, and common Peacock; but there are several groups in which the cock has two or more spurs on each leg, such as some of the African Francolin Partridges (*Pternistes*) and the Asiatic Spur-Fowls (*Galloperdix*) with two, the females of the latter having one; the Peacock-Pheasants (*Polyplectron*) and Blood-Pheasants (*Ithagenes*) have variable numbers in the male birds, in the common Himalayan Blood-Pheasant the cock having up to four on one leg and five on the other; while I notice that in three wild-bred and fully adult cock Grey Peacock-Pheasants (*P. chinquis*) in the London Zoo at present one bird has two spurs on each leg, one one on one leg, and the third none, from which I argue that such multiple spurs do not seem to be of much use. Besides the hen Spur-Fowls, the hens of the Crestless Pheasants (*Acomus*) and of the Javan Pea-Fowl are spurred as well as the cocks.

The long single spurs seen in the Fowl and some

similar birds are really terrible weapons; the wild Jungle-Fowl is a terrible fighter for his size, and his least-modified tame descendant the game-cock, a professional gladiator, has even been known to kill a fox, this supreme gallinaceous exploit having been chronicled in a sporting magazine about a hundred years ago.

Ceylon Jungle-Fowl can beat ordinary tame Fowls, and the common Indian red one has been seen to thrash a Kaleege Pheasant (*Gennæus*), which is more than a match for our Pheasants. So is the little wiry Gold Pheasant, curiously enough, a result which must be due to his extreme activity, since his spurs are rudimentary. The springing necessary in birds which fight with both feet at once, as these do, gives of course a great advantage to the more active bird if other qualifications are anywhere near equal; the average heavy tame Cock cannot beat the common Pheasant, though the Jungle-Fowl can do so. Besides the slayer of Reynard, another game-cock, recorded in Tegetmeier's poultry-book, has won fame by killing a Kite, and even the game-hen, as Wright's poultry-book relates, has been known to kill a rat, a Rook, and even a Hawk.

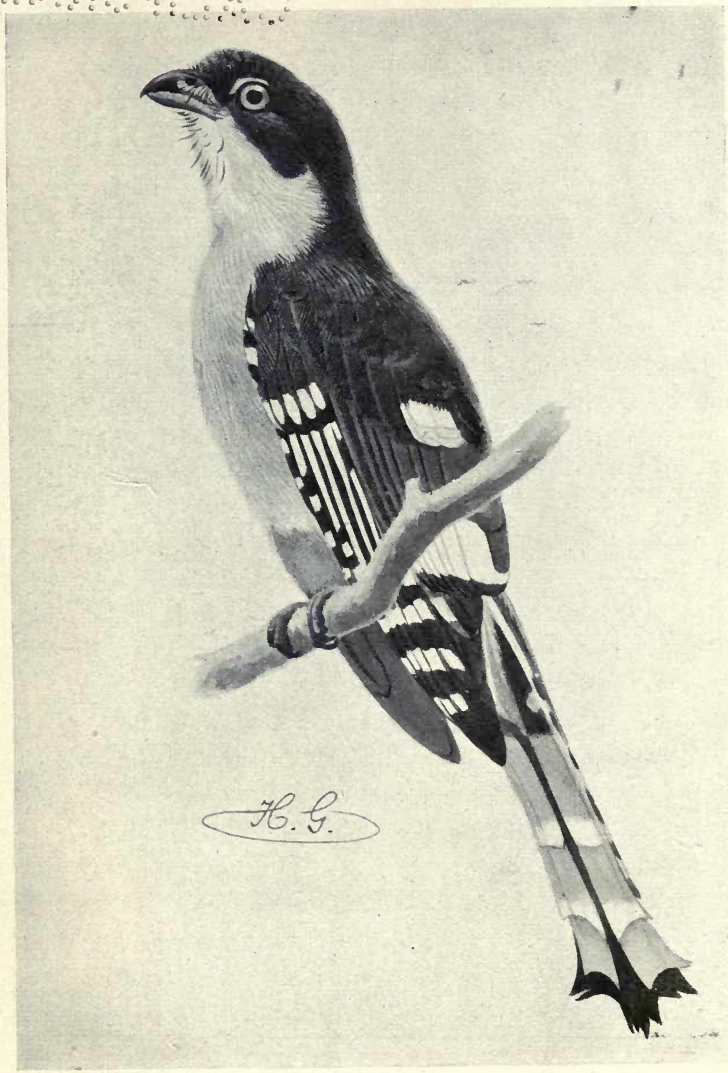
As Mr. MacDonald, the pheasant-keeper at the Zoo, gave me an opportunity of observing, the Globose Curassow Cock (*Crax globicera*) when attacking his attendant's foot, did not strike, but gripped with the claws and bit, thus showing a method of attack more like that of a Passerine bird, and to these

perchers the Curassow and Guan family show a slight approximation in form and habits, being the least specialized of Game-birds. The grappling unscientific method of fighting is very marked in Passerine birds, whose fights are regular "tooth-and-claw" performances. Rails, such as our Moorhen and Coot, also grapple in this way.

The Game-birds, especially Grouse, use their wings as well as their beaks and feet in fighting, but the most notable wing-fighters are the Pigeons, the Duck tribe, the Plovers and Snipes, and the Penguins. Some of these groups are regular professional boxers, and may be even armed with knuckle-dusters, as the Sheldrakes and that giant extinct flightless Pigeon, the Solitaire (*Pezophaps solitarius*) of Rodriguez; or have spurs on the pinion-joint, as in the Spur-wing Geese (*Plectropterus*) and Spur-winged Lapwings of several kinds, besides the "lily-trotting" Jaçanás, several of which are spur-winged. The Screamers have two spurs on each wing—a large one on the pinion, and a smaller one nearer the tip of the wing. All spur-winged birds are spurred in both sexes, and in none of them do the spurs represent claws, being never at the ends of the digits. The Torrent-Ducks (*Merganetta*) of the Andes have spurs on the wings, but here it is just possible that these may be grappling-irons for climbing slippery rocks, as the New Zealand Torrent-Duck (*Hymenolæmus malacorhynchus*) is said to use its wings for scrambling up rocks, though in this species they are only knobbed, not spurred.

AFRICAN JAÇANÁ.

Showing the long toes and claws characteristic of this family of birds, and enabling them to walk on water-plants.



CUBAN TROGON.

Noticeable in the Trogons are the very grouse-like wings and bill, though the habits of the birds are not at all like those of Grouse.

The spurs of the great Spur-winged Geese are certainly very formidable weapons, for it has been found possible to leave these birds out in the open at night at the Cairo Zoo, although jackals and wild cats visit this at night. Similarly at Calcutta, where similar quadruped foes were to be feared, Sarus Cranes, White Siberian and Manchurian Cranes (*Antigone antigone*, *Anthropoides leucogeranus*, and *Grus viridirostris*) could be left out, as well as Adjutant and Marabout Storks (*Leptoptilus dubius* and *javanicus*) and Jabirus (*Xenorhynchus asiaticus*), while the smaller Storks and Cranes had to be shut in. The bayonet-like bills of these birds are formidable weapons, and they are not antagonists which man himself would wisely attack unless armed at least with a stick; no doubt there was some truth in the classical legends of pigmies being defeated by Cranes, especially if by this title, as I have elsewhere suggested, one of the great carrion-eating Storks was meant. In the fights of the Adélie Penguin it has been noticed that the males "fight fair" with their flippers, but hens bite like suffragettes.

Those most redoubtable fighters, the birds of prey, whose daily food is often gained only by a fight, rely mainly on the terrible stroke or grip of their talons, and use their beaks but little, though the Falcons often break the neck of the quarry with the bill after bringing it down. When cornered on the ground, they go over on their backs to fight, as do Herons also. Often Hawks and

Eagles fight in mid-air, grappling with the claws and spinning round and round; but they generally let go in time to avoid a fall. Quite innocent-looking little birds may however forget to do this; I once picked up in the Calcutta Museum buildings a couple of House-Swifts (*Cypselus affinis*) so tightly clenched claws to claws that it was quite difficult to pull them apart. No doubt it is loss of presence of mind owing to over-excitement like this that makes Sea-Eagles and Ospreys hang on to too strong prey till they are drowned, since under the fear of man they can let go their grip of their quarry quickly enough.

Some birds rely almost entirely on biting, such as Gulls, Shrikes, and Parrots, the last of which can of course do great execution; but Parrots have a silly-looking habit of trying to ward off a foe with one foot, which looks like asking for trouble, for both they and some stout-billed Finches, such as Weavers and Java Sparrows, make a point of biting the adversary's feet, like hyænas among mammals.

It is curious, by the way, that birds seldom aim at the throat of their enemy, the back of the head being the part attacked in most cases. The weakness of their necks, always comparatively long, puts them at a great disadvantage in contests with beasts, but on the whole they "get a good deal of their own back," and large numbers of the smaller and younger carnivorous mammals fall victims to birds of prey; I have heard of a case of the Nepal Eagle-Owl (*Huhua nepalensis*) killing a full-grown

civet-cat, to say nothing of the instances of raptorial prowess related in a previous chapter.

Mammalian enemies, however, and in the tropics snakes, crocodiles, and the large lizards, account for an enormous number of birds, and their ravages are in many cases chiefly directed against the more or less helpless young. Fish and other purely aquatic creatures take their toll; pike are great enemies to young waterfowl; tiger-fish (*Hydrocyon*) in Africa have been seen to take Bee-eaters when swooping to the surface of water, as trout take flies; a fin-back whale has been found to have swallowed several Cormorants; and no doubt the almost complete absence of diving-birds from the tropical seas is connected with the abundance there of sperm-whales and of sharks and other large predatory fish; it will be noticed that the mammalian analogues of such birds, the seals, are also very scantily represented in tropical waters.

Of special defences against attack, such as one sees among mammals in the armadillos, and among reptiles in the tortoises, we find little trace in birds, though their feathers are of themselves a very efficient armour, often even turning shot, as sportsmen well know. The air-celled skin of the Screamers may act as padding against their wing-spurs when they fight, and the callous pad on the breast of the Ostrich commonly receives the kick of his adversary, though its primary utility is most evidently to bear his weight when lying down.

The frill and warted face of the Ruff have been

cited as defensive structures, but this view is, I am sure, quite mistaken; the fights of Ruffs are most feeble affairs, the birds never really hurting each other even though fighting, as they often do, when in undress; their beaks are blunt and weak, they do not use their feet, and all they can do is to slap with their wings, the blows of which do no serious harm; while as to the facial warts, some specimens never develop them at all.

A much better defence is "bluffing" by expansion of the wings or feathers, as is done by Owls, Bitterns, Painted Snipe (*Rhynchæa*) and other birds; this often suffices to keep the enemy from hostilities altogether, and may be the original object of the so-called sexual display. The Swan and the Mandarin Drake certainly believe in displaying to bluff an enemy, and so do the Peacock and Turkey-cock, while the Ostrich often displays before commencing hostilities—in fact, the habit is very general among birds, and may be compared with the hair-bristling of mammals.

I have seen some very amusing instances of this, as when a Canadian and a Greylag Gander once defied each other by display before me in Regent's Park, with out-stretched necks and lowered and out-spread tails; ultimately the Canadian lay down as if daring his enemy to shift him, whereupon the said enemy sheered off and declined actual hostilities. I have also seen in the Calcutta Zoo a Crane try to bluff a Pelican by opening its bill at it, only to flee in horror when the Pelican returned

the compliment—though as a matter of fact a Pelican is a very poor fighter for its size, and I have known of two instances in which one of these awkward birds was killed by a Swan.

The plumage of birds is not only a good defence against injury, but against weather, the feathering of many land-birds, even, throwing off water almost as well as that of most waterfowl; but even among wild birds, if they are living under easy conditions, as with birds in London, one may observe a strong tendency to degeneration in plumage in some cases. Sparrows with very faulty plumage and broken tails are common in our town parks nowadays; I have also seen at least two Moorhens with quills broken off short, and several Black-headed Gulls whose plumage was not properly waterproof.

Rigorous climatic conditions would of course eliminate such birds, to say nothing of enemies; but when birds definitely make beasts of themselves by losing the power of flight and running about on the ground, the state of the plumage does not seem to matter, and practically all such birds have degenerate loose-webbed plumage, the precise degree of degeneracy corresponding pretty closely to the degree of degenerate deviation from the normal bird type; thus, the plumage is most degenerate in the Cassowaries and Emus, which have the most aborted wings, less so in the Ostrich, and still less in the Rheas, in which the wings are almost like those of normal birds, although soft-quilled. The flightless Rails and Parrot show much less marked deviation,

but the tail is distinctly affected, and it will be noticed that defective quill- and tail-growth is quite common among domestic birds, as well as among the above-noted Cockneyfied wild ones.

Very perfect weather-resisting devices are to be found, on the other hand, not only in the down underclothing of waterfowl, but in the curious cleansing and water-proofing powder to be found in the plumage of so many different groups, notably in Herons, Pigeons, and Cockatoos, and in the great bald Carrion-Storks like the Adjutant. Although, as will be seen, some of these birds are waders, none are habitual swimmers, and none are such vigorous bathers as most birds, the Cockatoos apparently only bathing in showers of rain.

Powder-dusted plumage is always very close, and as it cleans itself, may be looked on as the perfection of feathering, although the actual powder is said to be produced by the disintegration of individual feathers during growth, these "pulviplumes" occurring either scattered, as in Cockatoos, or aggregated in patches, as in Herons. Finally, it will be noticed that whenever plumage is not directly concerned with promoting flight or giving cover from the elements, it has a strong tendency to become loose and degenerate in structure, as in the Peacock's train and many Paradise-birds' plumes, as well as in the Ratite birds above referred to.

CHAPTER XII

Special instincts of birds—The play of young birds and of adults —Bower-builders and their peculiarities—Ornamentation of nests—The instinct for food-storage in some forms—The practice of piracy—Toilet and bed-time habits.

It is in the study of certain special and sparse-distributed instincts of birds that their mental and moral similarity to ourselves often comes out best, and though in Europe we are not as well off for birds with habits of striking interest as are some of the other continents, there is yet now and again a point of much sympathetic interest to be gleaned from the study of our species.

Playfulness for instance is well developed in some European birds; the young of the Redpoll bred in an aviary have been described as playing about like kittens, just as I have seen young aviary-bred Budgerigars do. Not only do young ducks of various species play, but I have seen full-grown and full-plumaged drakes do so, a favourite trick with Mallard being to fly for a few feet just above the water and then close the wings and dive headlong into it—exactly the manœuvre the young but fledged Gannet performs in practising its trade, judging from some they had at the Zoo some time ago.

I have even seen practical jokes played by a Sheldrake and by a Pigeon; in the former case the bird, a pinioned one in Ravenscourt Park, London, was being chased by a spiteful Swan, and took long dives to avoid it, the enemy vindictively plunging head and neck under the surface to observe its course; at first I pitied the duck, thinking it was a new arrival and afraid to come ashore near the spectators, but when it tired of the sport it did so, standing and pluming itself with such nonchalance that it had obviously only been amusing itself at the Swan's expense.

The case of the Pigeon was even more remarkable; some very small boys in a narrow back-street were chasing a young street-Pigeon which kept flying hither and thither for a few yards only at a time. I was considering whether I ought to stop them, or let one catch it to take home for a pie—as they were not well-to-do youngsters—when, to my surprise, as it alighted not far from me, I saw it was not panting or exhausted, and soon after it flew up on to a high roof, showing as plainly as possible that it, as well as the boys, had been enjoying the game.

I have already alluded to the practical joke of a Carrion-Hawk on an Eagle, and every one knows the inveterate propensity for such jokes in birds of the Crow and Parrot tribes, the last-named birds being particularly apt to use their acquired gifts of speech in this way; every one has heard of a Parrot who calls the dog and then tells it to "go

and lie down" or in some other way makes sport of the confiding canine. The Mocking-bird also appears to be a bird of much malicious humour; at any rate Colonel Roosevelt tells of one which made a point of pecking a quiet old dog's tail whenever he dared to raise it above the horizontal; and I have seen one in the London Zoo which, in the course of a few minutes, mocked the notes of a Bulbul (*Pycnonotus*) much to that bird's apparent annoyance, chased another smaller bird about the aviary till it clung to the wires panting, then left it and proceeded with much stealth to steal a stick from a pair of silly Pigeons which were making a futile attempt to nest on the grass-plot in the centre of the aviary. Among other groups than Passerines, Cockatoos, Lories, and Cranes are remarkable for their playfulness, which seems never to leave them at any age.

Pigeons, being clumsy and harmless birds, come in for a good deal of attention from practical jokers in feathers; I have seen a Peregrine Falcon which haunted the Calcutta Museum buildings in winter amusing himself by swooping down on some tame ones and then "throwing up" at the last moment, for he had a truce with his neighbours and did not kill on the premises; and, at the other extreme, one may often see them in London chased on the wing by the mischievous Sparrow, and putting on great pace and some most active twisting to escape the attack in the rear threatened by the impudent little wretch. I have seen the Sparrow

play the same game on the Collared Doves loose at the Zoo, on the Starling, and even once on the wild Duck. Except for practical jokes of this kind, I have not seen the Sparrow play, or fly for amusement; in fact, Passerine birds, except the Crow tribe, though so light and active, seem seldom to fly for sport, though many sing in the air besides the Skylark.

Sportive flights, however, are common in birds of other groups, and merge imperceptibly into courting displays; even the slow, greedy Wood-Pigeon towers up and sails down in the courting ecstasy, and the more active and cheerful common Pigeon is very fond at all times of gliding for some distance with upward-slanting wings in true Eagle fashion, an action which the Pouter among domestic breeds indulges in in exaggerated fashion, being a Pigeon which carries out all Pigeon peculiarities to extremes.

Jackdaws soar up in pairs in true raptorial fashion in the spring, and Rooks go in for all sorts of aerial antics before changes of weather, while I have seen both the Calcutta House-Crow and Carrion-Crow in London play a game very like "I'm king of the castle," in the former case on our lightning-conductors on the Indian Museum and in the latter on the weather-vane on a Regent's Park church. The Indian Crow also likes swooping down on Dabchicks, evidently being amused to see them dive, for he has far too much sense to think he can possibly catch them.

The play of adult birds leads naturally to their "balls" and tournaments, which, though undoubtedly connected with matrimonial arrangements, have yet very much the character of assemblages for amusement; in many cases, as in Blackcock dances, a great amount of fighting goes on with little real damage, although the more solitary Capercailzie really mauls his opponent savagely. The fights of Ruffs, also, do no more harm than a glove-fight, and although Peafowl and Mandarin Ducks, judging from their habits in captivity, like to assemble for display, there seems to be little real fighting among them; in the case of the "beauty shows" of the latter, which I have often observed in the evening at the Zoo, it always seemed to me that the birds were all paired already, and came together—on land, be it noted—night after night simply for the fun of the thing, although the ducks did their best to incite the drakes to hustle each other.

It seems as if there is a tendency in highly evolved species, however courageous, to leave off fighting and concentrate on display, and in the well-known case of the Bower-birds of Australasia (*Ptilonorhynchinæ*) the play-place is actually laid out and in many cases decorated by the birds. It is to be noted that these extraordinary developments of bird instinct have occurred in a continent where man was, till we developed it, rare and at a low level, which, taken into consideration along with the human attributes so often noticeable in the

Penguins, which usually live where there are no men at all, looks as if, in the absence of human civilization, and the presence of easy means of living, the birds do their best to become civilized themselves.

There are several gradations in this instinct of bower-building, the simplest form of it being seen in the Tooth-billed Bower-bird (*Scenopæus dentirostris*) which simply carpets a patch of ground with large green leaves, and the most elaborate that of Newton's Bower-bird (*Prionodura newtoniana*), which builds an extraordinary avenue of sticks, higher on one side than the other, which it decorates with white flowers only; the placing of these flowers is the prerogative of the old cocks, which are often brought to blows by the action of one in removing a decoration which another has set up, while the hens and young birds simply look on and applaud. The smaller and simpler avenues of the Satin Bower-bird (*Ptilonorhynchus holosericeus*) and of the Spotted Bower-bird (*Chlamydodera maculata*) have long been well known, and that of the former used usually to be on view at the Zoo under the old management.

The Satin-bird decorates with everything it can get, with a preference, as remarked previously in this book, for blue; the Spotted Bower-bird has a special preference for bones and shells, and its bower looks like a badly-arranged local museum. The Gardener-birds (*Amblyornis*) build structures like little huts, with a sort of garden outside, in

the case of one species decorated with moss and picked flowers and shoots, and in that of the other with sticks and black beetles and berries. Bower-birds will visit lonely huts, at times, to steal objects, recalling the well-known propensity of their relations the Crows, which hoard both trinkets and food.

The instinct of food-storage, important as it is, has been developed in but a few birds, chiefly Passerines, and it is especially noticeable in the Crow tribe, though one does not often get a chance of observing it in wild birds. It is, however, particularly well known in the Jays, which, feeding so much on such non-perishable food as acorns, have every encouragement to develop the habit. Tits also store food, the Cole-Tit being particularly assiduous, when fed at a bird-table, in carrying off bits and coming back quickly for a fresh supply. The Nuthatch has the food-storage instinct well developed, and a caged pair I had not only stored sunflower-seed in the chinks of the back of their large cage, but even live harvest-men-spiders or daddy-long-legs, without even taking the trouble to kill the unfortunate arachnids, but jamming them in ruthlessly and leaving them to kick.

Shrikes, also, are suspected of impaling their prey alive in many cases; the habit of doing so, which seems to be far better developed in the northern than in Indian species, is no doubt a form of food-storage, for they are quite capable of holding their food in their foot like Hawks, and

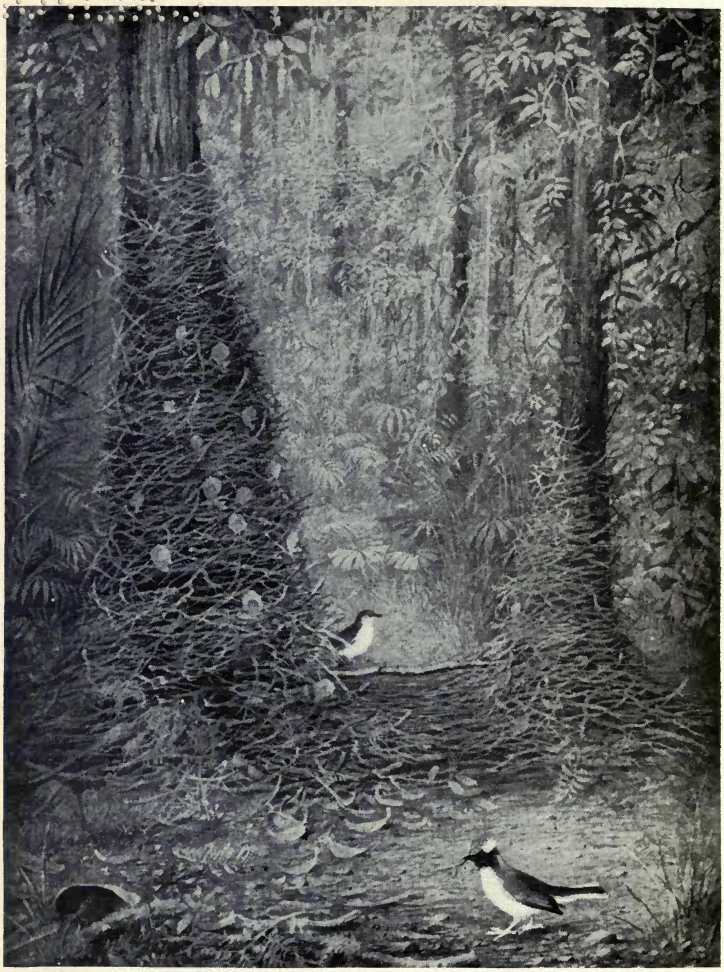
do not really need to fix it up in order to tear it. I once saw a Drongo-Shrike, a Bhimraj or Great Racket-tailed Drongo (*Dissemurus paradiseus*), grip and scalp a gecko-lizard I gave him alive, thinking he would kill it more quickly and mercifully than I could, whistling meanwhile with horrid pleasure. Needless to say, I did not give him any more live lizards.

Similar cat-like cruelty has been observed by Darwin in the case of a Cormorant, which amused itself by letting go a captured fish and catching it again, and by Buller in the case of a New Zealand Hawk (*Hieracidea*) which carried up two mice, one in each foot, and dropped them to catch them again, till he lost one, and decided to end the misery of the other by eating it. Cruel as it is, this habit is particularly interesting, as there were no mice in New Zealand to play with before we came, though no doubt the young of the Maori rat and of the native Quail (*Coturnix novæ-zealandiæ*) had to put up with similar maltreatment before the white man and the mice appeared.

The Carrion-Hawks of South America, so Crow-like in their ways, develop the storage habit in captivity at any rate, for I have seen both the Caracara and Forster's Milvago (*Ibycter australis*), the "Jack-Rook" of the Falklands, store away food at the Zoo. Owls are very great at keeping larders, and often accumulate quite a quantity of prey in their nesting-places, which, unlike most birds, they use as true homes, not merely as nurseries. Among

GARDENER BOWER-BIRD WITH ITS BOWER.

This species, except for its orange crest, is brown; when expanded fully the crest is round and flat like a dandelion flower.



NEWTON'S BOWER-BIRD.

Newton's Bower-bird is brown and yellow in plumage, and about the size of a Blackbird, which makes the huge dimensions of the bower more remarkable.

Woodpeckers, the American species *Melanerpes formicivorus* stores acorns in holes bored in tree-trunks, and even in telegraph-poles.

Parrots are usually not only non-provident, but, like monkeys, wantonly wasteful, which wastefulness, I am inclined to suspect, is one reason why they are so rare outside the tropics, with this suicidal tendency to squander their supplies; so the case of a Grey Parrot communicated to me by Mr. W. Elcome, a resident in my neighbourhood, is particularly interesting—his bird at meals asks for food, and drops it, till it sees it can get no more, and then proceeds to eat what it has begged for.

Rather reminiscent of the habits of both Bower-birds and Shrikes is the trick which some birds have of lining, and possibly, in their own opinion, ornamenting, their nests with curious objects of animal origin, the most conspicuous cases being of those birds which insist on using a snake's slough for this purpose, such as the Great-crested Fly-catcher (*Myiarchus crinitus*), one of the American Tyrants, and the Rufous Warbler (*Aëdon galactotes*) of Europe; in India the black Robins (*Thamnobia*) and that burrowing Starling, the Bank Mynah (*Acridotheres ginginianus*) also have this curious selective habit. All the birds with this liking for snakes' old clothes breed in holes, and it has been suggested that the slough is used to terrify intrusive lizards, which are no friends to eggs and young birds, and are themselves much preyed upon by snakes.

Among quaint bird customs, a very widespread and reprehensible one is that of piracy, the Frigate-birds and Skua Gulls, which live largely on what they frighten out of other birds, being the acknowledged professional exponents thereof, while many birds, both on land and sea, attempt it in an amateur way. Eagles are notorious highwaymen as well as pirates, for though the malpractices of the American "Bird of Freedom" on the Osprey are most notorious, the inland Eagles are every whit as bad where Hawks are concerned, as is well known to Eastern falconers; Prince Mirza Mohammed, in his admirable treatise on Hawking, translated by Colonel Phillott, advises falconers to go out for their sport early in the day, because Eagles do not begin to soar and look out for plunder till the sun is high. Gulls in different parts of the world rob Lapwings and Oyster-catchers, and surface-feeding Ducks like Wigeon will sponge both on diving Ducks and on wild Swans, their own powers of exploiting the bottom being limited as a rule to depths of a few inches.

Kingfishers may both rob and be robbed; I have seen a White-breasted Kingfisher (*Halcyon smyrnensis*) in India—a very poor fisherman—rob a Dabchick once, and evidently meditate the act oftener, and Mr. D. Dewar has seen another Indian Kingfisher, the Pied, *Ceryle varia*, badly badgered by a River-Tern (*Sterna seena*), which wanted a frog it had caught.

The Sparrow, as one might expect from his

hooligan instincts, is a thorough petty pirate; Americans complain that he robs the fine Thrush they call a Robin (*Turdus migratorius*) of its earthworms, and I saw only last year the same trick played on a Starling on a little London grass-plot. The curious part of the business is that one never sees a Sparrow trying to catch worms itself, and also in the case I saw, the want of resentment in the Starling, usually a plucky bird; but it is noticeable that with birds, as with ourselves, there is a general tendency to be deplorably patient under imposition.

Although other animals besides birds assiduously clean themselves, as one may see with flies and cats, birds have some toilet customs peculiarly their own. Of these washing in water is undoubtedly the chief, for though beasts and reptiles may wallow, they do not wash deliberately as birds do. Bathing, however, is not universal among birds; some preferring to roll in dust and throw it over themselves, like the common Fowl, whose dry-cleaning habit is shared by all the Game-birds, as also by the Cariama and the Bustards and Sand-Grouse. Among the great runners, also, though the Emu and Ostrich wash, the Rhea dusts, picking up and throwing the dust over itself with its bill. I have also seen a Red-billed Hornbill (*Tockus erythrorhynchus*) in the Zoo dusting, but I do not know if it bathes as well, as some other Hornbills do.

Bathing and dusting are seldom practised by

the same bird, but the Sparrow, as is well known, does both, and I have also seen both habits in the Green Bee-eater of India (*Merops viridis*), the Blue Roller of the same country (*Coracias indica*), and the South American Seed-Snipe (*Thinocorys rumicivorus*). Larks dust, but also bathe in the rain, lying down in it with outspread wings, and the Wren is said to dust—I do not know if it bathes.

Many fine flyers take their dip on the wing, as every one has seen with the Swallow; the Bee-eater above mentioned, the Roller, and the Drongo or King-Crow (*Dicrurus ater*) also bathe in this way. So do Humming-birds and Kingfishers, the land-feeding species of the latter family, as well as the fishing kinds, plunging for a bath. All the above birds use their feet but little, and take their food by the use of their wings, even if by short swoops; but among birds which are active on their feet I have seen bathing by a plunge practised by the Silvery-crowned Friar-bird (*Philemon argan-ticeps*)—a very agile acrobat in the air, in spite of short wings, however—and I have seen a Wood-Pigeon in St. James's Park on a hot day pitch on water out of its depth, and have a splash or two before flying out, and this habit seems to be well established both in this bird and the House-Pigeon. The latter exemplified to me the passion of birds for bathing in a very striking way one cold winter's day at Charing Cross. The station-yard cobbles were glazed with ice, but on them a score of Pigeons flapped and wallowed in the cold shower thrown

on them by a cabby, who had got his finger on a fountain-jet and was making it spirt. Many must have seen similar Spartan behaviour on the part of many of our small garden birds in winter, such as the Robin.

One curious thing about birds' bathing is that they are much more particular about their bathing water than that which they use as a beverage. They will drink any dirty water, but much prefer that which is clean to bathe in; even Ducks will not go into a pond which has become excessively foul, and if there is any difficulty about their water supply it is much better to give them merely a large tin bath filled afresh every day than to dig out a pond, if this must become stagnant owing to want of facilities for renewing the water. It is a similar feeling, no doubt, which makes sea-birds resort to fresh water for bathing wherever possible; even the Johnny Penguins (*Pygoscelis tæniata*) in South Georgia have been found to resort to a fresh-water lake for fresh-water bathing. In fact, they liked the pond so much that, according to the observer who records the habit, they went there to die, many dead specimens being visible in the clear depths.

It is a familiar observation that water rolls off a Duck's back, and as a matter of fact, the clothing of waterfowl is generally waterproof, as one would expect, though not in the Magpie-Goose or in Cormorants, whose habit of standing with expanded wings to dry themselves after fishing is well known.

Any water-bird also, when kept away from water for a time, loses the waterproof property in its plumage, this being most marked in the most aquatic kinds such as Grebes and Petrels; nor is the plumage of dead birds waterproof. This being so, it is difficult to see how the waterproofing efficacy of the oil-gland over the tail, the only important skin-gland birds possess, comes in, although it is admittedly especially well developed in waterfowl, and these may be seen repeatedly rubbing their heads on it after bathing and when pluming themselves.

Another puzzle in the toilet arrangements of birds is the comb-like edge on the inner side of the third claw which some birds, such as Nightjars, Barn-Owls, Herons, Grebes, and Cormorants, possess; it is true that birds always scratch themselves with this claw, though it is not the nearest to the head, that place being held by the second toe or inner front one (the hind toe being the first), nor, in the case of Grebes and Cormorants, is it the longest. But though this argues that the comb-edge where it exists has some function, it does not explain why it is so curiously distributed—one could hardly have two birds more dissimilar in habits than a Barn-Owl and a Dabchick, for instance. In the Frigate-bird, which is very verminous, the claw-comb appears to act as a vermin-catcher, but a verminous condition does not seem to be universal among comb-clawed birds by any means, and is often found in others, such as the Starling.

The roosting-habits of birds display some interesting variations. Generally in repose birds "tuck their heads under their wings," as the popular description of the action has it; in reality the bill or head rests between the basal joint of the wing and the back, and is merely covered by the adjacent shoulder-feathers. Some birds, however, such as Owls and Penguins, very rarely assume this position, and, as far as I have seen, Grebes and the Ratite birds, with the exception of the Apteryx, always keep the head to the front. Some birds lie down when sleeping, such as the Game-birds, the Cariama, and the Ratites, as well as many waterfowl; but others prefer to sleep standing on one leg, such as Storks, Cranes, and Passerines. Parrots and Owls rarely sit down, either by day or night, and generally rest on both feet; the diurnal birds of prey also generally prefer a standing pose at all times, with the exception of the American Vultures, which sit down when at roost.

The hold upon the perch, among those birds which roost aloft, is maintained automatically by the flexure of the toes which results on the bending of the hock-joint, so that no effort is required; but the grip must be very slight in those perching birds in which the hind toe is poorly developed, as in the perching species of Ducks and in the Cariama, which also has very short front toes. An even more remarkable percher is a Demerara Tinamou which, according to Waterton, has the custom, unique, apparently, in its family, of sleeping

in trees. Its short front and rudimentary hind toes are most ill-adapted for such a habit, and Waterton considered it maintained its position by the rough scales at the back of the shank.

Some birds roost by hanging themselves up, either suspended absolutely head-downwards like bats, which is done only by the little Bat-Parrots (*Loriculus*), or by clinging to some support head-upwards, but suspended against it by the claws, like Woodpeckers, Colies or Mouse-birds, and some at any rate of the Swifts. Swifts of the most typical kinds, however, like ours and the Indian and African House-Swift (*Cypselus affinis*), roost in their nests, a habit rare among birds, but also followed by Martins, Tits, Owls, Petrels, and the common Pigeon and Wren. In the case of the latter, many birds will crowd into one nest or hole in winter, and even then often die in a hard frost.

CHAPTER XIII

Special physiological peculiarities of birds—Longevity—Temperature of body—Change of colour in bare skin of some, such as Turkey—The phenomena of the moult—Gradual change in colour of bill and feet according to age and sex or season—Changes in iris colour—Beak-sheath shedding as in Puffin.

Birds are by far the most perfect of living machines that evolution has as yet produced, for although they do not nearly equal reptiles in longevity, they live much more intensely and exhibit incomparably more activity, which must fairly be taken into account. In length of life, however, they are vastly superior to most of the mammals, though, as in so many other cases, length or shortness of life is a group-character, and in birds of the same group is related in many cases to the size of the species. The evidence goes to show that the longest-lived birds are the larger species of Parrots, birds of prey, and waterfowl, but it must be remembered that the data are necessarily obtained from birds in captivity or domestication, and that large species are generally easier to keep and less liable to accidents than small ones.

But there is no record of any small bird of the above groups attaining even half the age that is recorded, for instance, for the Lemon-crested

Cockatoo, a specimen of which, known to be ninety-six years of age, was exhibited at a bird-show at the Horticultural Hall in London in 1913, while another has recently died in Australia at the record age of a hundred and nineteen; or of the well-known London Swan, "Old Tom," killed by accident at the age of seventy. The Game-birds are not usually notorious for longevity, but some years ago a record was published in *The Field* of a Peacock killed by accident at ninety-six, and Lady Warwick in recent years has possessed a white one which, as recorded in *Country Life*, must have been nearly a century old, since the oldest man on the estate, it seems, said that his father, who died a very old man, could remember knowing this bird as an adult in his own boyhood.

There are no records of the Raven tending to confirm the extreme length of days traditionally attributed to it, no captive specimen having even reached the three-score years and ten allotted to man; but the smaller Passerine birds are certainly very long-lived for their size, the Canary commonly living ten years and sometimes twenty, while a tame cock-Sparrow of seventeen years old is recorded by Mr. Hudson in his "London Birds." These celibate birds, however, very likely have their lives unnaturally prolonged by never breeding; and a bird in captivity, in spite of the drawback of want of exercise, has a chance of surviving many years after its constitution has become too weak to bear the violent exercise of escaping from Hawks

and intermittent starvation, troubles which fall to the lot of most birds in a state of nature.

Thus I knew for years an old hen Lapwing in the London Zoo which died at the age of at least fourteen; but for years before her death, apart from the fact that she had a stiff wing—no doubt due to some accident—she was in a most unfit state for survival in the wilds, since, a few weeks after she had moulted, her quills regularly became so worn that she would have been greatly handicapped in flight, and flight is the most important survival-factor in this bird, its activity on the wing being too much for the average Hawk.

Almost up to her death, however, she laid an egg or two annually and sat on them, but these never hatched, though as her mate was a Ruff, the hybrid alliance may have accounted for this! Mr. Meade-Waldo's classical pair of Eagle-Owls, both of which exceeded sixty years, also bred up to within a few years of their death, and the long-continued fertility of the Goose is familiar to poultry keepers. The Duchess of Bedford, however, recorded in "British Birds" a Collared Dove which at the age of thirty failed to fertilize its young mate's eggs, so there we get an approximate limit to the fertility of this species, which, by the way, is one noted for longevity, in which it far surpasses the Pigeon, a larger bird and kept as a rule under more natural conditions. Among aviary Pheasants, however, the small Golden and Amherst species do not live nearly as long as the larger Silver Pheasant,

nor do the Mandarin and Carolina Ducks as a rule equal the length of life of the Mallard, which is itself less long-lived than the Muscovy.

Fowls are usually not allowed to live long, but I have seen a hen which, I was told, was twelve years old—she certainly looked it; and I have also seen a Bantam-cock of seven, which, though elderly-looking, had sired chicks the year I made his acquaintance. The historical game-cock who killed the fox, also, was three years old at the time, and was winning contests with his own kind at six years. It would be interesting to know how long Humming-birds live, and Mr. Ezra's two specimens have given us some information; at the time of writing he had had them a year and a half, and they were adults when received, so that at any rate these birds are not short-lived like insects, as many people seem to think they should be.

They do, however, resemble insects in becoming torpid when exposed to cold, and those species which range to Canada, Alaska, and Patagonia presumably undergo this torpidity regularly every night in spring and autumn; Gould's pair of the Ruby-throat (*Trochilus colubris*) certainly did so when on board ship in cold waters, but this may have shortened their lives, as one died in the Channel and the other on reaching London. Very young birds, whether nestlings or chicks, also become torpid when exposed to cold.

Generally speaking, the temperature of birds is exceedingly high, and maintained under all cir-

cumstances, no bird being known to hibernate, though many, especially Swallows, have had the reputation of doing so. It has been suggested that Petrels, dislodged in winter from their burrows by a fall of rocks, etc., from a cliff, may have accounted for this, and certainly Storm-Petrels could easily be mistaken for Swallows; and Pliny must have confounded Shearwaters with Swifts, since he says that however far ships went from land, the Swifts (*Apodes*) still flew around them, which exactly applies to these Petrels.

The temperature of the Ratite birds is lower than that of the ordinary types of the class, and in association with this approach to the mammalia it may be noted that these birds are less long-lived than large birds in general, not reaching apparently more than thirty years.

One peculiarity of birds to which little attention has been paid is the change of colour or form, or both, to be observed in the bare skin of some forms; it is most conspicuous and best known in the Turkey, in which the caruncle over the beak becomes, as every one has seen, enormously elongated and hangs down on the neck, the throat-skin meanwhile becoming loose and pendulous, while the colour of the neck becomes red, with the face bright blue and the crown bluish-white, the ordinary colour of the naked parts being a dull light red or livid. It is interesting to note that in the splendid Honduras Turkey (*M. ocellata*), in which the bare parts are normally rich blue with yellow warts,

the colour of these does not change, and that the neck-skin is but slightly relaxed, though the beak-caruncle elongates, and there arises an almost conical comb, crowned with warts, on the top of the head. In the Green Jungle-cock the single wattle is let down, and the face becomes red, on excitement.

In the Common and Silver Pheasants the bare skin of the face expands both above and below when excitement supervenes, and the same phenomenon is seen in others, such as the blue-faced Firebacks (*Lophura*), but there is here no colour-change. On the other hand, colour-change may occur without change of form of the naked parts; thus in the Caracara Hawk when courting, and sometimes under other circumstances, the salmon-pink cere and bare face become pale yellow; and the red face of the Bateleur Eagle (*Helotarsus ecaudatus*) becomes yellow, and its red feet flesh-coloured, when feeding, the change beginning even at the sight of food. Yet when showing off, which this species, unlike other birds of prey, constantly does, the face and feet become intensified in their red colour.

In the Pileated Vulture (*Neophron pileatus*), on the other hand, the sight of food makes the livid bare parts of the head turn brilliant rose-pink. In the Blue-and-yellow Macaw (*Ara ararauna*) and the Cape Crowned Crane (*Balearica chrysopelargus*) the chalky white bare face blushes reddish on excitement. Thus we may see among birds a facial

change under emotion very similar to our own, and in some cases carried further, for our features at least do not alter in shape! The expansion of the bare parts is said to be effected by the injection of blood, but the pouches of the Adjutant and of male Frigate-birds are air-inflated.

In some birds, as in the Comb-Duck (*Sarcidiornis melanonota*) and Sheldrake, the male assumes a permanent fleshy outgrowth on the bill during the breeding season, which is much reduced at other times. In the American White Pelican (*Pelecanus erythrorhynchus*) a horny excrescence grows upon the bill during the breeding season, and is afterwards shed; it has been said to be confined to the male, but the hen of the pair in the Zoo at the time of writing has grown one for years past.

The moult of the feathers has always attracted attention; in most birds it takes place once a year, but in some, especially where there is a great change of colour according to season, as in Ptarmigans and the males of some Ducks, it occurs twice. The quill-feathers, however, are only shed annually, and generally in pairs, so that the bird's power of fligh tis not importantly affected; but in several groups of water or marsh birds, which can take refuge in water or on boggy land, all the quills are cast together, so that the bird is flightless for some weeks; such groups are the Duck tribe (except the Magpie-Goose), the Flamingoes, the Rails, the Grebes, and the Cranes (except the Crowned Cranes (*Balearica*)).

It is interesting to note that the terrestrial forms of some of these families, the Cereopsis among the Geese, and the Land-Rail and Wekas among the Rails, nevertheless still keep up the wholesale moult of their, presumably, marsh-living ancestors, and that the Ratite birds do not cast all their quills at once, though there is a strong tendency to wholesale moulting whenever possible; thus the ornamental plumage of the Gold Pheasant and Peacock is shed very rapidly, as are the great show-quills of the Argus. The Penguins also moult very quickly, throwing off their feathers in masses, and as they do not go into the water till clean-moulted, have to fast for a period of several weeks.

The colour of the beak and sometimes the feet changes in many cases according to season; thus the cock Chaffinch's bill is flesh-colour in winter, blue-grey in summer; and the Starling's beak changes from black in winter to yellow in summer, and its legs from dull brown to fleshy red. The legs of the breeding Night-Heron (*Nycticorax griseus*) also change from yellow to salmon at the breeding season, and in some races of the Great Egret (*Herodias*) the bill and face change, from yellow, to black in the former and green in the latter. Drakes when assuming the female-like plumage they bear for a time after breeding may or may not change the colour of their bills; there is no change in the Mallard or Pintail, but the Gadwall and Shoveller assume the female colora-

tion of the bill, while in the Red-crested Pochard and Mandarin this change is variable, occurring in some individuals and not in others.

The colour of beak and feet, etc., also changes according to age; this is very noticeable in the bill of the cygnet of the common Swan, which changes from black, through grey and lilac, to pink, and finally to orange-red; but the change from black to red can also occur by the gradual invasion of the black by the red, as in the beak of the young Zebra-Finch (*Tæniopygia castanotis*). In the young Gannet the beak changes from black to white, and the green lines down the black shank and toes only appear as maturity approaches. The legs and bill both change from black to white with age in the Indian Pied Mynah (*Sturnopastor contra*). Changes in the iris are quite numerous in birds. Usually a dark eye changes into a light one; thus the grey Parrot, when young, has a dark grey iris, and the Ring-necked Parrakeet (*Palæornis torquatus*) a dark brown one, both having the iris white ultimately. But the reverse change may occur, for in the Pheasant-tailed Jaçaná (*Hydrophasianus sinensis*), the young birds generally have yellow eyes, and the old ones dark brown ones. In the Gold Pheasant the young cocks can be known by their yellow instead of brown eyes long before coming into colour. Indeed, generally speaking, the change, due to age, in the beak, feet, and iris, tends to antedate the change in plumage; but there are exceptions, as in the case of the male

Blackbird, which gets his black plumage long before his bill turns yellow.

The iris, like the face and feet, may change colour through emotion; thus the red eye of a Pochard drake has been seen to change to yellow, no doubt through fear, while he was being handled. Besides changing colour, the horny casing of beak and claws may undergo actual shedding *en masse*, as distinct from the ordinary gradual wearing. I have already cited the case of the American White Pelican, and may now draw attention to that of our Puffin and of various nearly allied members of the Auk family, in which more or less of the horny sheath of the bill comes off in large pieces after the breeding season, producing in the larger-beaked forms a most remarkable change of appearance, for in the Puffin the bill, shorn of its nuptial plating, is quite ordinary in size and shape.

Among the Grouse, the Ptarmigans lose in spring the exaggerated overgrowth of horn on the claws which they acquired in autumn to fit them for winter's snow-shovelling in search of browse; and the more ordinary Grouse such as Blackgame and Capercailzie also shed the horny fringes to the toes which served in winter to provide a kind of snow-shoe. Even weapons are shed seasonally in at least one instance, that of the Pheasant-tailed Jaçaná, which loses its wing-spurs as well as its long tail after the breeding season.

CHAPTER XIV

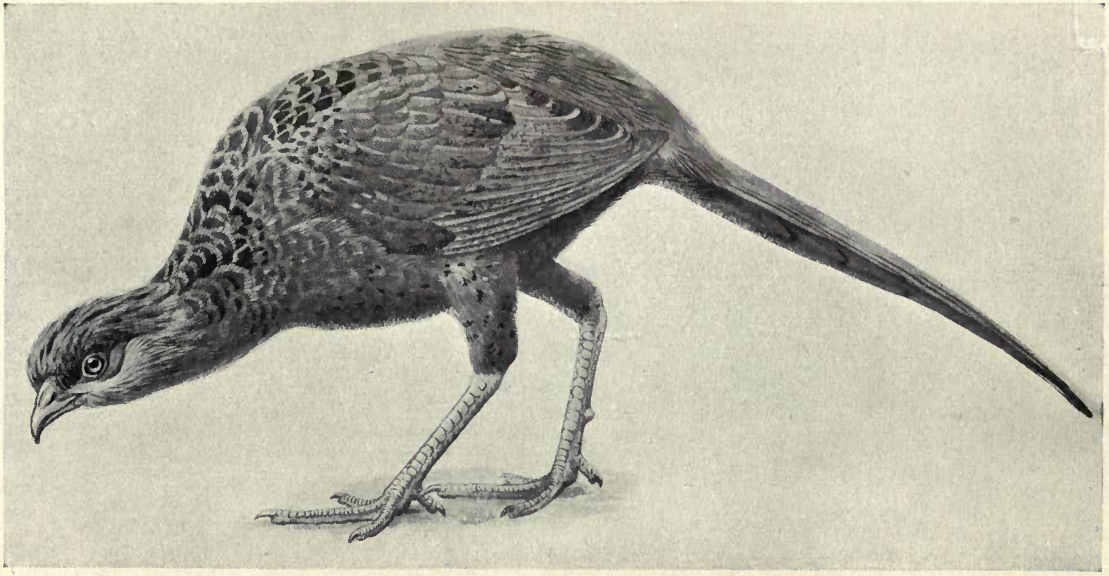
Abnormalities—Hybrids, their characteristics and power of reproduction or otherwise—Abnormal plumages, such as albinism or melanism, temporary or permanent—Overgrowth of claws and bill.

ABNORMALITIES, both of mating and of plumage and structure, have not received the attention from naturalists which they deserve, though from the philosophic point of view they are often of extreme interest. The few facts that are known about hybrid birds, for instance, are often extremely suggestive. Though generally intermediate in appearance, as is the case with the very well-known hybrid between the Goldfinch and the Canary, they often differ from both parents, special decorations, for instance, being almost invariably eliminated by the cross, unless common to both species. Thus the hybrid between the Gold Pheasant and the Fowl has neither the comb, wattles, or bending sickle-feathers of the one parent, nor the crest and extreme length of tail of the other, while the colour is of an ordinary auburn or chestnut instead of the rich and variegated hues of the original birds.

This uniform chestnut hue turns up so frequently in Pheasant crosses as to suggest that the

original Pheasant was of this colour, though no such species now exists; and it is also common in parts of the plumage in crosses among waterfowl. Glossy purple is also a common colour where gloss exists in the parents, although purple gloss is rare in pure birds. In the cross between the common red Jungle-Fowl and the green Javan bird, for instance, the hybrid cock has a purple neck and tail, both neck and tail being green in the Javan species, while the tail is also green even in the red bird. Similarly with regard to the appearance of auburn, the breast of the hybrid Gold-and-Silver Pheasant is of this colour, although one parent has a scarlet and the other a blue-black breast.

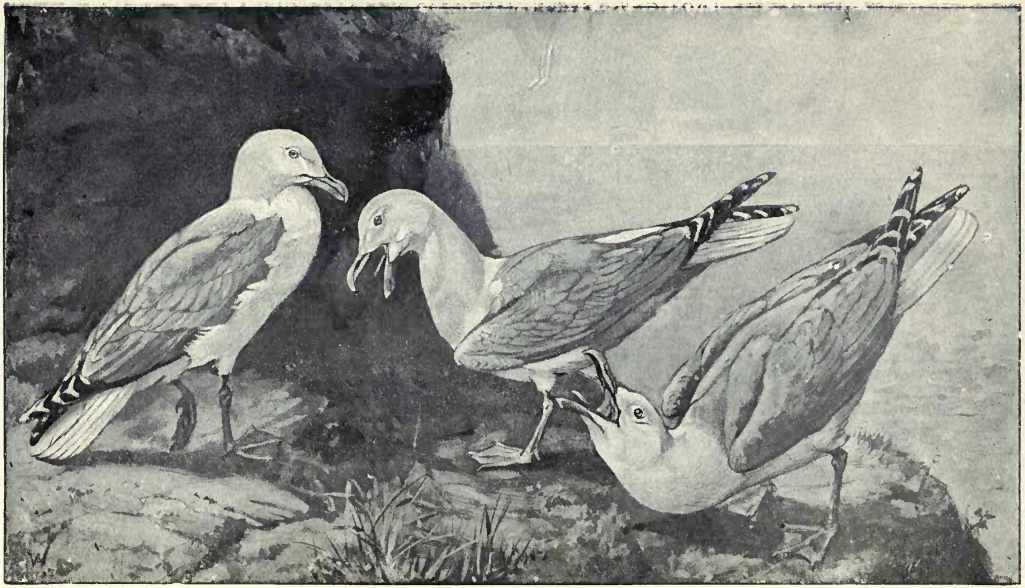
In the hybrid of the Mallard and the Red-crested Pochard both tendencies appear; the breast is fawn, quite unlike the chocolate of the Mallard and the black of the other Duck, while the head is of a metallic puce, a colour one would never imagine to have been derived from the Mallard's emerald-green and the Pochard's chestnut and buff. It is obvious in such cases that the colours are not blends of those of the parents, and the inference would seem to be that chestnut or rufous, and purple, were formerly commoner colours among Ducks and Pheasants than they are to-day; since among crosses of varieties of the same species of domestic birds there is a strong tendency to reversion to the original colour, Darwin having got birds resembling the Rock-Pigeon and the Jungle-Fowl by crossing different breeds of



HYBRID BETWEEN GOLDEN PHEASANT AND FOWL.

It will be noticed that the ruff found in both parents, the comb and wattles of the fowl, and the full crest of the pheasant, disappear in the hybrid.

[*By permission of "The Graphic."*



HERRING GULLS.

The most familiar of our large gulls, whose eggs and fledged young might well be used for food.

Fowls and of Pigeons which were all devoid of the ancestral colours, as related in his admirable but rather neglected work, "Variation of Animals and Plants under Domestication."

Now and then hybrids between species have been produced showing an extraordinary likeness to some species allied to, but distinct from, the two forms concerned; the classical instance of this is that of the two Sheldrakes bred at the Zoo many years ago between the little-known South African Grey-headed Sheldrake (*Casarca cana*), which much resembles the Ruddy Sheldrake, and our common Sheldrake; these resembled the Australian dark grey Sheldrake (*Casarca tadornoides*) far more closely than either parent. These birds are to be seen at the South Kensington Museum. At the Zoo lately, also, was a cock Pheasant presented by Mrs. Johnstone, the first importer of the Formosan black Mikado Pheasant (*Calophasis mikado*), and bred between that bird and the copper-and-white Elliot's Pheasant (*Phasianus ellioti*) of China, which, except for rather different breadth in the bars on the tail, was identical in plumage with a third species, Mrs. Hume's Pheasant (*P. humiæ*) of Manipur; a form far less specialized in coloration than either of the other two, and very likely ancestral to both, just as the dark grey Australian Sheldrake no doubt represents an ancestral form of these Ducks, generally so strikingly and showily coloured.

Rarely does a hybrid between distinct species follow almost exclusively one parent in coloration,

but this is the case with the hybrid between Ruddy Sheldrake and Egyptian Goose (*Chenalopex ægyptiaca*), which favours the former; between the Pope Cardinal-Finch (*Paroaria dominicana*) and Red-crested Cardinal (*P. cucullata*), which follows the latter; and with hybrids between domestic Fowls and other birds, such as the Pheasant, Guinea-Fowl, and Peacock, in all of which the coloration is purely that of a Fowl or nearly so, so far as I have seen. Specimens may be studied at South Kensington.

When the colour is thus dominant, however, the shape and size incline more to that of the recessive parent; thus, the very rare Peacock-Fowl hybrid shown recently at the Zoo was a most obvious Peacock in size and general shape, though in accordance with the general rule of the "cancelling out" of different decorations, it never developed train or crest any more than comb, hackles, or wattle. The Cardinal hybrid had the short head-feathering of the Pope, not the long peak-crest of the other parent.

When two species of Ducks, one with an undress plumage in the drake and the other without, are crossed, the undress is dominant and such a phase occurs in the hybrid, as is well seen in that between the Rosy-billed Pochard (*Metopiana peposaca*), which always retains masculine plumage, and the Red-crested Pochard with its very distinct eclipse. I note, however, that in a hybrid between the Red and Green Jungle-Fowls now in the Zoo there is no "undress" neck-feathering assumed,

in which the hybrid follows the Javan, the Red Jungle-Fowl assuming after breeding a neck-wear of short black feathers instead of long red hackles, though this change can seldom be traced in the tame Fowl, which generally "skips" this undress phase.

Among the Ducks, where habit may vary so much, we have a chance of comparing the habits of hybrids with that of the parents; the diving-habit would appear to be recessive, as hybrids bred by M. Rogeron between a Pochard drake and a Gadwall-Mallard hybrid duck were not only non-divers, but more terrestrial than ordinary Ducks, though heavily built; and of several hybrids between surface-feeders and divers I have myself seen I never saw one dive, though it must be remembered that some of the true diving-ducks, the Red-crested Pochard for instance, seldom dive in captivity even on large ponds; while on small ponds much more specialized diving-birds show a tendency to become abnormal and avoid diving and often even swimming; thus, the King Penguin last at the Zoo would not enter water.

The perching habit, in a duck bred between a percher and a non-percher, appears to be dominant; at any rate, several hybrids between common and Muscovy Ducks I had in Calcutta took to perching, though at first awkwardly, sitting along the bough lengthways; they improved later, however, and assumed the normal transverse position, and roosted in the tree, showing a stronger proclivity for perching than the pure Muscovy, though this is a tree-

duck when wild, and half-wild ones bred at the Zoo perched freely if left unpinioned. As, however, the ancestor of the Ducks was a percher—if the Magpie-Goose really represents it—this would again be a case of reversion. The greater readiness to take wing in these Muscovy-Mallard hybrids, which has long been well known, as they have often been shot in a wild state, is undoubtedly a reversionary trait, the common Duck being usually flightless and the tame Muscovy very lazy, though able to fly.

Generally speaking, hybrids between remote species, placed universally in different genera, such as most of those of which I have been speaking, are inclined to be wild and spiteful, and are almost universally sterile; so much so, that one cannot persuade bird-fanciers that the Goldfinch-Canary "mule" can ever breed. A few years ago, however, a bird was exhibited at a Horticultural Hall bird show which purported to be a cross between a Goldfinch-Canary and a true Goldfinch, and as it looked exactly what one would expect such a bird to be like, and most certainly not like the ordinary first cross or like any casual variation of the Goldfinch, I am inclined to accept its authenticity; especially as M. Suchetet, in his book on wild hybrids in birds, mentions breeding on one occasion from the hybrid between the domestic Dove and Pigeon, mated back to a Dove, though this cross is also usually quite sterile.

Hybrids between closely allied species, such as the Amherst and Golden Pheasants, and Mallard and

Pintail Ducks, are normal or nearly so in behaviour and reproductive power; when bred *inter se* the second generation do not segregate again into the original forms or break up into numerous varieties, as do the offspring of crossed domestic breeds, but remain nearly or quite true to type, so far as the few experiments yet made give us information.

The blood of several species can be blended into one hybrid, as in the case of the triple-crossed Ducks mentioned above, and Mr. J. L. Bonhote has crossed as many as five species, but all nearly allied; M. Rogeron's hybrids of the Gadwall-Mallard with the Pochard were sterile. They were, by the way, true to type, and showed rufous in parts of the plumage where no such colour was found in the parents, another instance of reversion to this colour.

Recently there was bred at Kew a brood of hybrids between a Chilian Yellow-billed Teal drake paired to a duck bred between a Chilian Wigeon (*Mareca sibilatrix*) on the one hand, and a hybrid between the Madagascar Meller's Duck (*Anas melleri*) and the African Yellow-billed (*A. undulata*); the result of this mixture being very fairly uniform and exhibiting far more rufous than any of the parents, and a blackish cap and whitish face and throat also found in none of these, and on the whole displaying a reminiscence of an Australasian Tree-Duck (*Dendrocycna vagans*); here again is a probable case of reversion, the Tree-Ducks being a primitive type, un-duck-like in gait, shape, flight, and note, though typical in bill.

Hybrids have generally to be studied in captivity, where they are so freely produced that in many cases a bird is practically as likely to breed with an ally as with its own species, the reason for which has been suggested at the close of Chapter VIII, as dependent on personal preference; but in a wild state they are always, with one exception, very rare, even among the Ducks, in which group they occur more frequently than in any other birds, though in the Goose and Swan section of the same family unknown.

Thus, in India, Hume in all his many years of wild-fowling and collecting, and in spite of his numerous correspondents, apparently never came across a specimen, and indeed only one undoubted one to my knowledge has ever turned up there, recorded by Mr. W. L. Sclater a few years before I went out; this was between Mallard and Gadwall, but in general coloration more recalled a Teal, which must make one careful about assigning ancestral reversion to hybrids which resemble species not concerned, for there is no reason to suppose the Teal to have been ancestral to Mallard and Gadwall, unless the latter has much degenerated in colour. I am therefore inclined to agree with M. Suchetet, that the comparative frequency of wild-fowl hybrids in Europe is due to the amount of shooting that goes on, and to the practice of keeping waterfowl pinioned, both causes leading to birds being deprived of the power of flight, and so unnaturally isolated in a territory they would not naturally

inhabit in the breeding-season, and thus being brought into contact with aliens.

The only common wild hybrid is the apparently sterile one between two very distinct species of Grouse, the Capercailzie and Blackcock, which is so well known on the Continent as to have a technical name, Rakkelhane, in Scandinavia. Many examples are to be seen in museums, and the cock hybrid is killed down by sportsmen as vermin, as it disturbs the pure-bred birds at their tournaments; the hens are inconspicuous and seldom noticed.

As to the common crosses of all grades between such birds as only or hardly differ except in colour, such as the Hooded Carrion-Crow crosses and others above-mentioned, I cannot consider them hybrids at all; as the birds, who ought to know their own nationality best, make no caste-distinctions on colour, I cannot see why naturalists should presume to do so.

Abnormalities in coloration which appear independently of crossing are often very interesting, whether they occur in tame, captive, or wild birds; in the last case the frequent whiteness or pied variegation of the Blackbird is of ancient notoriety, for Aristotle mentions white Blackbirds (which he thought were of a distinct species), and Varro speaks of their being shown publicly in Rome, along with Parrots, wild Fowls (probably Blackgame) and other curiosities. In the Faroes, a pied variety of the Raven used to occur frequently, but has now be-

come extinct with the killing off of the whole stock. One can understand how such a variety can recur, from the account given by a contributor to Wright's "Poultry Book" of the constant recurrence of a few silver-grey ganders in his strain of the ordinary dark-grey Toulouse Geese, after he had once used a gander of that colour.

Albinistic variation in birds is commoner in New Zealand than anywhere else, and it is interesting to note that it affects the introduced British birds as well as the native species, no doubt because in both cases in-breeding has followed the introduction, natural or artificial, of but a small stock; I have noticed that the plumage of most native New Zealand birds is extraordinarily soft and fluffy, no doubt another form of degeneration, as soft loose plumage is one of the surest signs of degeneracy in captive or domesticated birds. Albinism is generally replaced by lutinism, or yellow coloration, in green birds, whether pure green or olive-green; thus we are familiar with the yellow variety of the Canary, originally an olive-green bird, and in India a yellow variety of the pure green Ring-necked Parrakeet not unfrequently occurs. Such Parrakeets retain the red beak, and, if males, the red neck-ring; red having a curious tendency to persist in varieties otherwise abnormally coloured.

Melanism or abnormal blackness is usually rarer than albinism, but much commoner in birds of prey—except Owls. It must be remembered that albinos and lutinos often have pink eyes, and there-

fore no doubt, like human beings similarly afflicted, probably have bad sight, so that they are unfitted to survive in a state of nature. The white Australian Hawk (*Astur novæ-hollandiæ*) with its black-pupilled red eyes, thrives well enough, incidentally showing that there is no need for a bird of prey to resemble its surroundings for aggressive purposes.

Particularly interesting are the cases in which a bird varies into a different style of plumage than the black, pied, white, yellow, or so forth; thus, the brown Kaka Parrot (*Nestor meridionalis*) of New Zealand often produces a more or less red variety in nature; and in captivity I have seen a specimen of the very rare Derbian Parrakeet (*Palæornis derbianus*) at the Zoo become a different bird altogether, its pinkish breast turning green like the back, and its grey cap black like the throat, so that any one would have called it a distinct species, while its cage-mate remained unaffected. It afterwards, however, returned to its original colour, and this is always liable to happen with abnormally plumaged birds, unless they are pink-eyed albinos or lutinos, in which the abnormal plumage is permanent, so far as I know.

And as a bird may get more or less white with age, in captivity, as sometimes happens with the Linnet and usually with black breeds of the common Duck, it does not need Darwin's far-fetched theory about sexual selection and changes of taste in the females to account for the peculiar case of the Reef-Herons (*Demiegretta*) in which the birds should be

grey, but often are white when young, white when adult, or white all through life. These Herons are simply liable to temporary or permanent albinism, and in this connection it may be noted that there are more all-white species among the Herons than in any other group of birds; incidentally also, the white ones are just those which favour warm climates, where they are most conspicuous, like the white Cockatoos amongst the Parrots. Among Cockatoos and Herons, grey and black are also common colours, and all poultry-breeders know there is a close affinity between grey, black, and white, so that here laws of heredity have evidently determined the colour, quite irrespective of assimilation to surroundings.

The reversion of the captive cock Linnet to the young plumage in captivity is of interest in this connection, as also the change of the red to yellow in the males of some allied Finches, such as the Crossbill and Rose-Finch (*Carpodacus erythrinus*); in old birds this seems to happen in the wild state, and very old cock Linnets when wild seem to become yellow where they should be red. The fading of the red in both sexes of the captive Scarlet Ibis (*Eudocimus ruber*) seems to be a matter of some defect in the food; it cannot be due to climate, as this change occurred in the Calcutta Zoo, though our old cock always put forth some scarlet splashes in spring. Hen birds, being more delicate, might be expected to feel the effects of captivity more than cocks; I noticed recently the hen of the Zoo

pair of American White Pelicans had assumed the young plumage in the shape of brown markings on the wing-coverts.

The occasional assumption of male plumage by hen birds has generally been observed in birds in captivity, being most common in the Golden Pheasant; it is of interest that only the plumage changes, not the eye-colour. In the common Fowl the hen, though she may get spurs even when young, never develops the cock's large comb and wattles even when she becomes fully cock-feathered.

Overgrowth of claws and beak is very rare except in captive birds—in fact, I do not know any case of overgrowth of claws in a wild bird; such an accident, if it occurred, would so soon lead to a fatal entanglement or handicap in activity. In tame birds it is certainly not due to absence of friction in the case of the claws, for these will overgrow in Ducks, which do not normally frequent hard ground, and in cage-birds the claws will grow sideways away from the perch; so it seems to be merely a pathological over-secretion of horn, and may be compared to the similar overgrowth which takes place in the rudimentary back hoofs of many mammals in captivity.

The reproduction of lost parts seems not to occur in birds, at any rate as a rule; thus, a claw torn off is not replaced, as all bird-fanciers know. I have, however, come across one exception to this in the case of a specimen of Pel's Fish-Owl (*Scotopelia peli*) which lived for years at the Zoo. One

of this bird's huge talons was broken right off short, but was nevertheless reproduced so perfectly that no one ordinarily would have ever suspected the accident, though to me who knew of it the particular claw was always recognizable.

CHAPTER XV

Relations of birds with men—Persecuted species—Parasitic or commensal species—Domestic forms—Introduced forms and the results of introduction.

I HAVE not left myself very much space to discuss the especially interesting topic of the relations to our race of various birds, and this is a subject on which there is much to be said, and great divergence of views. While the ordinary "man in the street" is far too apt to pop off a gun at a bird he does not know, and hastily to order to execution birds which may not be doing the damage he thinks, or may offset actual damage by benefits done in other ways, the advocate of the birds makes himself or herself ridiculous by extravagant praises of the feathered folk, talking of them as if they were a set of angels, and arguing on the one hand that we could not exist without them, and on the other that we ought to exist for their benefit.

As a matter of fact, though on the whole hardly ever dangerous, and seldom seriously destructive, and often both directly and indirectly useful, birds are not indispensable, for their work in insect-destruction could be done by bats, batrachians and reptiles, to say nothing of insect-preying insects;

and as food they cannot compare in utility with beasts and fish, though they ought to be more used than they are, and indeed were so, not so many centuries back, even in this country, where a silly superstition against eating any birds other than ordinary game and poultry is springing up. As to admitting they have any "rights" to share our buildings and produce, I am a humanist, not a humanitarian; if birds get in our way, they must go, as the large beasts have gone, in my opinion—though I never met anybody more keenly interested in birds than I am myself, I only respect humanity.

At the same time, it may be freely admitted that man has in the past, and is still, far too hard on many species, and has even exterminated some quite gratuitously; though, as I remarked in a recent book of mine, "Wild Animals of Yesterday and To-day," it is fortunate that none of those exterminated are of very great account either æsthetically or scientifically. The Dodo is the only such one which has become popularly known, and only this and the tallest of the New Zealand Moas would attract attention in a live or dead zoological collection, as anybody may see if they can get a look through Lord Rothschild's monograph on Extinct Birds.

It must be remembered that most of the birds man has extinguished inhabited islands, and that in early days people had no exact ideas as to the distribution of animals, and so did not know the extent of the harm that was being done; even in the last century

an idea lingered that the Great Auk might be rediscovered in the Arctic regions, an area which it, as a matter of fact, never reached. When not insular in habitat, birds have generally become extinct through the habit of colony-breeding, a useful one in wild nature, because fighters like Terns and Weavers may beat off an enemy; and in any case the enemy, if always successful in raiding, is nevertheless likely to get tired of eating the same food, a change of diet being acceptable and generally essential to vertebrates.

When an Eagle used to alight on one of the trees inhabited by our free colony of Night-Herons and Dwarf Cormorants(*Phalacrocorax javanicus*) in the Calcutta Zoo, a roar went up from the combined cries of the terrified birds like a train entering a railway-station; yet I have not the slightest doubt that, though they made no attempts to mob him, he would not have broken up the colony even had he not been very unnecessarily shot. But then no human inroad was being made on these fishing-birds as well; when man wants birds and their eggs for his own use, to say nothing of other animals such as sheep, to which, for instance, Eagles are enemies, he must inevitably make war on the birds of prey; though there is no need to exterminate them completely, and as a matter of fact no bird of prey has been exterminated as yet, though many have been driven from districts they once occupied. Several Parrots have, however, been exterminated from islands, Parrots being both

very destructive to field and orchard produce and valued as human food.

It is curious how well some species of the smaller birds hold their own in spite of ages of persecution; the Quail has been massacred wholesale since the days of Moses, and probably long before that, and yet would hold its own well if it were not for the wasteful spring netting. The Blackbird and Thrush were favourite game-birds in the Mediterranean region in the classical ages, and are so still, and yet they are a great deal too common for the peace of mind of our fruit-growers; while even the little Blackcap Warbler is cited as a fruit-destroyer undeserving of protection, though it appears that Cyprus has driven a brisk trade in bottled Blackcaps since the Middle Ages!

The fact is, man creates by his cultivations and by the extermination of predatory wild life so favourable an environment for the weaker land-birds that he really gives back to bird-life in this way what he takes away by destroying forests, draining marshes, killing for food, and otherwise interfering with the larger birds, especially the aquatic and marsh-haunting species. Even these are very abundant yet in India, where the cultivation of rice, an aquatic plant, favours them; and the abundance of the birds of prey, so rare in Europe, strikes every one who goes out there.

The common Indian Kite, indeed, a local race of the Black Kite of Europe, is one of the species that may fairly be classed as a parasite or com-

mensal of man, since it lives chiefly on refuse from his food, makes its nest frequently on his buildings, and lines the said nest with rags if it can get them; and it is well known that the Red Kite (*Milvus regalis*) of Europe did the same here, until sanitation and the absence of garbage reduced it to a poultry-yard pest, and there was instituted a persecution of it which has nearly exterminated it in our islands.

Scattered here and there about the world there are many such house-haunting species of birds, belonging to widely different groups; commensals or beneficial allies rather than true parasites, since they generally pay for their lodging by services as scavengers or destroyers of pests. The feeling towards these varies from toleration, as in the case of carrion-birds like the Kites, the small Vultures of the Egyptian Vulture type (*Neophron*) and the Turkey-Buzzards and Black Vulture of the American Vulture-family (*Cathartidæ*), to positive affection such as is shown for the White Stork in Europe and Asia Minor, Abdim's Stork in Africa (*Abdimia abdimii*), and the Swallows everywhere, which really have a great deal for which to thank mankind, on whose homes they commonly prefer to build, abandoning in most districts their natural breeding-sites on cliffs or hollow trees.

Sparrows also, in spite of their pilferings, are befriended on the whole, and the common Pigeon is universally beloved, by Christians, Mohammedans, and Buddhists, and was probably not deliberately

domesticated till long after a period of commensal existence; at any rate in the East, the true wild Blue-rock of the Eastern race *intermedia* without the white patch on the back, is still found breeding not only in ruins, but in inhabited houses and in the sides of wells. A wonderful bird is this familiar creature, with an iron constitution which enables it to bear any climate from the Shetlands to Burmah, and to live on any food, from the scanty herbage of the cliffs to scraps of man's food found in our streets; near my lodgings I often see Pigeons picking even at bones and suet.

Indeed, if, as I suppose we ought, we look on man as part of nature, the Rock-Pigeon can claim to have beaten even the Turnstone, for it is probably far more numerous than that bird, now that man has added to its enormous natural range by taking it all over the world where the white race settles or trades. Only one other Pigeon has been domesticated, the pretty Collared Dove, a North-east African bird, which has varied but little, and yet retains a wonderful swiftness of flight when restored to liberty, in spite of a domestication of unknown date.

The Game-birds, however, have yielded the greatest number of domestic species, the Fowl being so familiar that, as Blyth pointed out, it has no name, "fowl" being simply Old English for "bird," and it is certainly at present the most important species to man. The Turkey, however, supplied its place with the aborigines of Mexico,

though in Europe and elsewhere in the Old World it seems to have remained solely as an article of luxury, having usurped the place which the Peacock held in Roman civilization. It does credit to humanity's love of natural beauty, so often questioned by nature-enthusiasts, that the Peacock, the most splendid of birds, is kept and has been widely disseminated for its beauty alone in modern times; and the same praise may be given to man for his domestication of the Golden and Silver Pheasants, and of a few less well-known species, as well as of the Guinea-Fowl, which used to be kept as a curiosity and no doubt was regarded as very ornamental, for Hasselquist says he considered it the most beautiful of birds after the Humming-bird and Peacock. Like the last bird, the Guinea-Fowl has varied but little, only showing colour-aberrations as a rule, though I once got one in India that would have delighted Darwin, as it had a pendulous tuft of feathers hanging from its neck, much like the Turkey's beard of bristles, which, Darwin said, would have been called a monstrosity had it appeared under domestication.

From considerations of beauty, too, the African tribes in some places, although the negro seems the least refined of human races, encourage the Northern Crowned Crane (*Balearica pavonina*) about their villages.

The Duck tribe have contributed the next most important quota to our domestic bird-world, and as the Indian Runner breed lays better than any

Fowls, may be destined to rise in importance. The Muscovy Duck, indeed, being widely kept not only in its tropical American home, but in Africa and the Pacific islands, may claim to be more important as food than any other tame bird except the Fowl, and is even more easily raised, though its utility is nowadays not recognized in Britain. The common Goose is the oldest of domesticated birds as far as positive evidence goes, long antedating the Fowl, to say nothing of the common Duck, whose domestication only dates back to the Christian era, since the Roman Ducks of that time were liable to fly away; the Muscovy had already been tamed by the natives when South America was discovered. The Chinese Goose (*Cygnopsis cygnoides*) is the Goose of India as well as China and Japan, and apparently kept in West Africa also, from its name of Guinea Goose, but the date of its reclamation is unknown.

Besides these practical waterfowl, we have domesticated the common Swan and the Carolina Duck—another tribute to man's love of beauty, for Swans are rarely eaten nowadays. It is a good thing that the Carolina's domestication is accomplished, for this bird is said to be in danger of extinction in America, where extermination seems to be most difficult of control. Perhaps, however, there is some weakness in the American birds which makes them "go under" more easily under persecution; it seems strange that the Passenger Pigeon (*Ectopistes migratorius*) should have become

extinct in half a century, while our Wood-Pigeon is so very common—indeed, too often a common nuisance.

As far as the Carolina Duck is concerned, it has always struck me that, although slightly larger and generally the winner in their contests, it is a less "fit" bird than its Oriental cousin the Mandarin, which is so freely imported from the East that its domestication has never been completed, and is certainly far more active, wiry, and versatile in its habits. Similarly our Greylag Goose is a harder-looking, more active bird than the splendid Canadian Goose, its analogue in the New World, although it does not seem able to stand up to it when it comes to fighting, where mere size in birds of the same habits is apt to tell, as cock-fighters well knew, endeavouring as they did to match birds of approximately the same weight.

Of Parrots we have only domesticated one Australian species, the Budgerigar, which is already a most formidable rival of the Canary; I hope in time it will supplant it, for Budgerigars are usually kept in pairs, and the worst infliction in captivity to a bird is the solitary confinement, except in the case of those unsociable species which prefer to be alone, and even they would like a mate when in breeding condition. I have noticed in the case of Pekin Robins, which are not true Robins, but Babblers, and so members of a very sociable group, that a single bird turned out will return to its companion or companions, but that if

you let out a pair or a number they will wander off; though in at least one case where this has been done a pair has stayed and bred, and the species is, I believe, established at the Duke of Bedford's park at Woburn.

Besides the Canary, which is a bird of recent European domestication, man has domesticated, at some unknown date and in the far east of Asia, two Weaver-Finches, the Java Sparrow (*Munia oryzivora*), of which the domestic form is white or pied, but with a strong tendency to revert to the original lavender-grey, and the Sharp-tailed Finch (*Uroloncha acuticauda*), a little brown bird whose dark pied and cinnamon pied varieties—they are seldom pure white—are known in the bird trade as "Bengalese." Both wild and tame forms of these two Finches are imported, but in the Java the wild form is far the most common in the bird trade, whereas with the other bird it is very much the reverse. The Java Sparrow has been established as a wild bird in many places in the warm parts of the Old World, even as far from its original home as Zanzibar and St. Helena.

Finally, within the last half-century the Ostrich has been fully domesticated, surely the most remarkable of the conquests of man, this swift creature of the desert being the very emblem of freedom, in spite of its flightlessness; and this domestication has not only saved it from much persecution, but caused it to be transported to most quarters of the globe, for there are Ostrich

farms now in Australia and both North and South America, though in South Africa there has been, it seems, such a drop in value of late that the poor birds have been allowed even to die of neglect, if press information is correct.

Taken altogether, man has done well with his domesticated birds; all, or nearly all, are species of remarkable interest in some way or other, even the plain-coloured Grey Goose being a bird of unusual intelligence and character, while there is nothing in wild nature more noble and gallant than the poets' favourite, honest Chanticleer:

> "While the cock, with lively din,
> Scatters the rear of Darkness thin,
> And to the stack, or the barn-door
> Stoutly struts his dames before."

And to have disseminated this fine bird from his Indian home "to the cold white ends of the north" and to the farthest Antipodes' seems to me alone to atone for what man has done in the extermination of some unfortunate forms of bird-life.

The Fowl has run wild over a vast area to the east of its original habit, so that its exact original wild boundaries are unknown, and it ought to be encouraged to become feral in all tropical countries, if only as a food supply for explorers, who often find it nearly as easy to starve in the tropics as in the cold zones. New Guinea, for instance, is a country badly deficient in food supplies at present, and feral poultry there would be a useful stand-by.

I have always been a supporter of the artificial extension of the range of desirable birds; as we must, in our own interests, curtail the range of some species, it is only reasonable that we should extend that of others, while the harm supposed to be done by introduced birds is in most cases grossly exaggerated. According to the current stories, which are circulated by exactly that class of naturalist which hunts to death the last remnants of hard-pressed species, introduced birds increase enormously, change their habits and become a pest, and persecute to the death the "interesting indigenous avifauna."

The real facts are that any bird which increases largely and is at all omnivorous is liable to change its habits and become a pest in its own country or any other, for where individuals are numerous there is always a greater chance of some striking out a new line; I have noticed, for instance, that in the few cases in which I have seen Starlings feeding in a street, they have always been single birds, and those that roost on Nelson's Column in Trafalgar Square (where, curiously enough, they never alight on the statue of the hero himself) used, when I first observed them some years ago, only to drop in in ones and twos, and not, as now, in parties.

So it is, no doubt, that one hears complaints about introduced Starlings from fruit-growers in Australia—and also in England, now that this bird has so much increased here. As to the effect on the interesting indigenous avifauna, this, as

the case of the sheep-killing Kea in New Zealand, and of many fruit-eating birds in Australia, well demonstrates, can do a bit in the way of change of habits and pestiferousness itself, and I have yet to discover the species of bird which is known to have been exterminated by the introduction of an avian alien. Even the Sparrow, which is certainly the worst character on whom we have endeavoured to confer the citizenship of the world, has a good word said for him by some New Zealand naturalists, and is doing something to reinstate his character in America by a vigorous war on that most serious pest, the alfalfa weevil.

Where native birds are scarce, or where man makes the land uninhabitable for many of them by cutting down the ancient forest, as he generally has to do, new birds must be introduced if birds are as useful as they are supposed to be, and so the Starling and House-Mynah will have to be distributed over the world, as they have been in Australasia, unless ornithologists find out some way of preserving native species in new countries. Fortunately, there is no sentiment against the introduction of game-birds and wildfowl, and the sporting interest is always powerful for the establishment of preserves for them; and as the conditions of such preserves—the provision of plenty of cover, food-supplies, and ready access to water—are just those which are favourable to bird-life in general, the sportsman is in the long run the best friend of the birds. He may, and does, favour the particular species in

which he is interested at the expense of others. But Nature, let alone, does just the same; and after seven years' of observation of her policy in India, it seems to me that man's methods are better; for although I am no sportsman, yet, as a naturalist, I would rather see a country swarm with wildfowl and game than with Hawks and Crows.

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